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ABSTRACT

Part of a larger project designed to produce a causal model of variables that impinge upon training interventions and influence adult learning, this research is concerned with learner attitudes toward the way employee training is delivered and the roles these convictions play in learning. Two research models served as a guide for comprehensive data collection in four studies of major plant safety training programs. The first three studies were concerned with energy control and power lockout (ECPL), safety training for operators of powered material handing vehicles (PMHV), and plant pedestrian safety. Instruction was delivered via group-oriented lectures and discussion with supporting videotapes in all three programs. The fourth study related to the same ECPL content as the first study, but the training format had been converted to interactive videodisc instruction. The studies employed a pre-/posttest survey design with the posttests administered 30-90 days after training. Two trainee populations for each study, hourly and salaried personnel, came from randomly selected classes in five to seven plants. Results of the studies showed that the subjects consistently preferred instructor-delivered delivery, and that self-directed learning methodologies were generally the least desirable for all groups. It was also found that adult attitudes toward training and the ways in which training programs are conducted do influence the fundamental success or failure of these programs both in the amount learned and in the generalized transfer of training principles to the workplace. A model of those factors which contribute to these training outcomes has been constructed and described. Two appendices provide additional information on the measurement of variables and path diagrams supporting a general model of delivery system preference effects. (14 references) (BBM)

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Adult Attitudes toward Alternative Delivery Systems and Industrial Training Outcomes

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FOUNDATIONS OF THE RESEARCH

Overview

This research is concerned with learner attitudes toward the way employee training is delivered and of the roles these convictions play in learning. It relates to media, but is not primarily concerned with media effects on the learning process, nor with the relative effectiveness of the alternative delivery systems. Rather, this research places primary emphasis on the learner—learner profile characteristics, and a range of learner attitudes—and the effects of these factors on training outcomes. While the general concepts studied here are pertinent to designing instruction for learners of all ages and for many instructional settings, this research was directed specifically towards adults participating in industrial health and safety training. It is part of a larger project designed to produce a causal model of variables which impinge upon training interventions, and as such influence adult learning.

The Adult Learner and Instructional Delivery Methodology

A traditional part of the "adult education philosophy" has been an emphasis on self-directed learning. Brookfield (1986) notes that "the development of self-directed learning capacities is perhaps the most frequently articulated aim of educators and trainers of adults (p. 40)." He continues to explain that "this self-directedness is usually defined in terms of externally observable learning activities". Knowles (1980) takes an even stronger position when he claims that the essence of adulthood is to move toward being self-directed.

Typically, this orientation towards self-directed learning is achieved through either "group-directed" or "individual-directed" delivery techniques. Examples of group-directed methodology include the use of small group discussions, role playing and simulations; individual-directed approaches would include computer-assisted instruction or programmed instruction. These are contrasted to "instructor-directed" methods, lecture being the most common example.

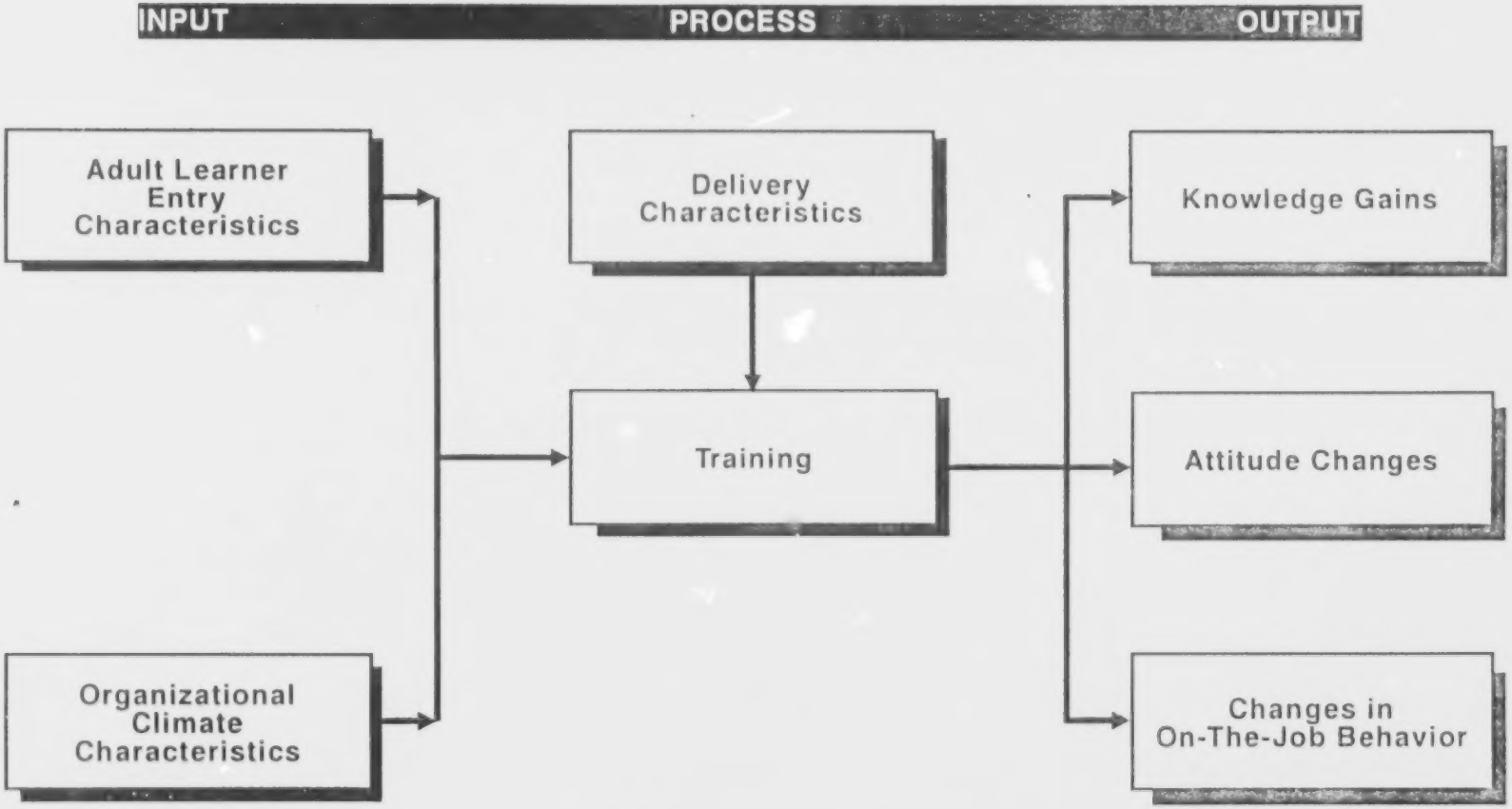
These observations are interesting in light of the common approaches to instructional delivery in corporate training. *Training* magazine's 1989 industry-wide survey showed that videotapes (used by 89.3% of responding companies) and lectures (used by 87.9%) were by far that most common vehicle for delivering instruction in the corporate training milieu. These are instructor-directed delivery systems. Group-directed methodologies were commonly used, but to a lesser extent: 58.1% used role playing; 43.9% used games and simulations in their training. In addition to these group oriented delivery systems, a smaller percentage used individualized techniques: 44.1% of the organizations with more than 100 employees engaged in computer-based training; 32.4% used non-computerized self-study programs; 11.4% used interactive video for training ("Industry Report", 1989).

Whether adult learners actually prefer those methodologies which rely on self-direction has not been empirically proven; nor is there confirmation of the assumption that self-direction is beneficial to the learning process (Caffarella and O'Donnell, 1987). In fact, the entire area of the influence of delivery system preferences on learning outcomes seems to be largely unexplored for adult learners. That is the focus of this research.

Research Framework

The general model upon which this study is based is shown in Figure 1. The model, basically an input-process-output model, shows multiple training outcomes and input from learners, environment, and delivery characteristics. In addition, it is a model which suggests causal relationships.

Figure 1
Model of Industrial Training Research



The model is reminiscent of other instructional effectiveness models. However, it is not a process-product model which has been used to guide a good deal of the teaching effectiveness research. Rather than attributing learner outcomes primarily to teacher performance as do many process-product paradigms, this model provides for the possibility of multiple clusters of outcome predictors.

This model also differs from the typical instructional design procedural model which relies on a systematic orientation. This model is consistent with a more systemic orientation, an approach which emphasizes the role in the learning process of a unified whole rather than identifying and analyzing separate components as is standard in the systems approach. The creation of the "whole" with respect to instructional design and learning requires that one address a wider spectrum of variables than has typically been considered in the design of instructional programs and materials. Thus, this model is directed toward factors other than those which concern the instruction's internal structure. I have previously reported on the role of organizational climate factors in determining industrial training outcomes (Richey, 1990), and this study extends the investigation of this systemic model into an exploration of the role of learner perceptions of the delivery system.

The specific hypotheses relating to the effects of learner attitudes towards alternative delivery systems are presented in the second model shown in Figure 2. (The variables in this model are derived from the more generalized research model presented in Figure 1.) The Figure 2 model suggests there is a web of relationships between basic learner demographic characteristics and learner attitudes which partially determine the outcomes of training. Specifically, learner attitudes toward one's job, training programs in general, and the content of the training are determined by the profile characteristics and the learner's perceptions of the organizational climate. These learner attitudes, then in turn, become predictors of the learner's attitude toward the training delivery system which directly affects training outcomes.

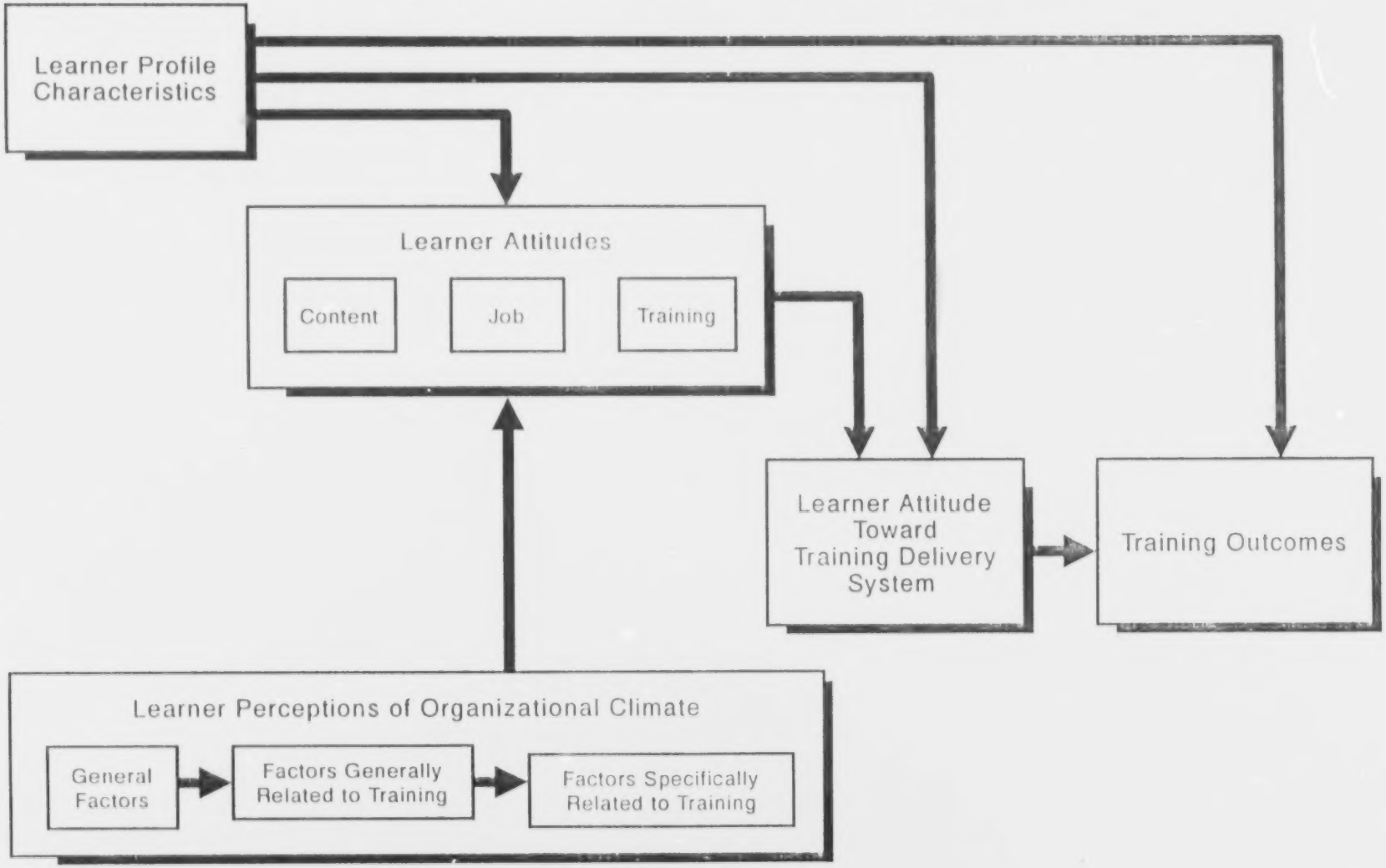
PROCEDURES

Training Framework

The two research models served as a guide for comprehensive data collection in four studies of major plant safety training programs jointly sponsored by an automotive union and a major automobile manufacturer. The first study involved a program related to energy control and power lockout (ECPL) in the plant. The topic emerged as a result of previous research and an examination of company accident records. Locking out involves shutting down the assembly line while completing diagnosis and/or repair tasks. Failure to lock out has resulted in serious injury and death. The locking out process, however, is expensive since it completely stops production. The training program on this topic was professionally designed and consisted of seven two hour sessions spanning two work weeks. Over 50,000 employees (hourly and salaried) participated. In addition, there was a one hour leadership commitment session for local plant and union management. The training was group-oriented lecture and discussion with supporting videotapes. There were pairs of trainers (one hourly and one supervisory employee), all of whom had participated in a special ECPL Train-the-Trainers program. They were not professional trainers, rather, they were released from their normal job assignments for this particular task.

The second study related to safety training operators of powered material handling vehicles (PMHV). The content focused on proper techniques for driving and controlling these vehicles in the plants. This program was offered for approximately 15,000

FIGURE 2
A Model of Hypothetical Relationships Between
Delivery System Preferences and Training Outcomes



plant vehicle operators and their supervisors throughout the corporation. The training consisted of four hours of group instruction supported by videotapes. Union leadership and plant management also had a one hour leadership orientation session. The program was professionally designed and delivered by trainer teams (one hourly, one supervisory) with vehicle operation experience. While they were not professional trainers, some had been trainers in the ECPL program.

Finally, an one-hour plant pedestrian safety course was studied. This program was delivered to approximately 125,000 persons, hourly and salaried, who are regular pedestrians in all plants of the company. It was a group-oriented seminar with supporting videotapes. It was professionally produced by the same firm which designed the PMHV training. Plant vehicle operators all took the pedestrian course immediately prior to the vehicle operation training. The same trainer teams were used for both PMHV pedestrian and operator training.

The final study related to the same ECPL content of the first study; however, the training format had been converted to interactive videodisc instruction. This program is required for all employees who had not participated in the previous group-oriented ECPL training, primarily new employees and persons who had returned from lay-off. The programs are being used in the plant computer labs or training facilities under the supervision of a training coordinator. Like the previous trainers, they were employees with ECPL experience, although not professional trainers. No formal computer training was provided for these trainers, although aid was available if requested. The exact same content previously incorporated into the group ECPL training is presented in the interactive video instruction. This training is in progress, and only preliminary data from this study is being presented here. The major emphasis is on the first three pieces of research.

Research Design

Not only was a common model of research variables used in these separate studies, but there were parallel data collection instruments and research designs. The research was conducted within the context of extensive evaluations of these safety training programs, and all procedures were approved by the both the union and the company.

The research employed a pre- and post-test survey design. The post-tests were administered 30-90 days after training to facilitate the collection of knowledge retention data, as well as a more realistic estimation of on-the-job behaviors.

The initial (but not the primary) thrust of the study related to describing the delivery system preferences of the adult trainees in the samples. All four trainee groups were used for this purpose. However, the major emphasis of the research concerned the effects of these learner attitudes towards the various delivery systems on training outcomes.

The dependent variables used in each parallel study were *gain scores* calculated from the pre-test and post-test measures of:

- Knowledge (based upon performance on objective tests of training content),
- Attitudes towards safety on the job (based upon self-report),
- On-the-job application of general safety precautions (based upon self-report), and
- On-the-job applications of specific behaviors taught (based upon self report).

The measures of the independent variables were essentially consistent from study to study. (In a few instances a given study had unique measures pertinent only to that

particular training program. In these situations the measures can be easily categorized and compared to similar measures in the other studies.) The clusters relate to the various components of the hypothesized model in Figure 2. The specific measures are listed in Appendix A.

Population and Sample

There were two trainee populations for each study, hourly and salaried personnel. The samples were selected on a stratified basis from plants representative of the corporation primarily in terms of plant type and size. Pre-test samples were: 389 ECPL trainees, 317 operator trainees, 201 pedestrian trainees, and a preliminary sample of 34 in the ECPL/IVD training. Post-test samples were: 284 ECPL, 241 operators, and 178 pedestrians.

Five to seven plants were involved in each study, and the trainees were in randomly selected classes within each plant. (Classes are formed in the plants randomly assuring roughly equal representation from each plant department.) Table 1 describes the trainees in the two ECPL studies in terms of gender, age, educational level, and employment experience. Table 2 presents the same information for the truck operator and plant pedestrian trainees in the two remaining studies.

Data Analysis

After obtaining descriptive statistics, path analysis was used to evaluate and to estimate the dimension of the model in Figure 2. The technique enables one to estimate the causal influence of a number of variables considered simultaneously. While the hypothesized model has been formulated on the basis of theoretical expectations, path analysis permits empirical evaluation. The first three studies only have been used in the construction of the final model.

RESULTS

Summary

This research posed two major questions:

- What delivery systems do adults prefer in industrial training? (Do they really prefer self-directed instruction?)
- Does it really make any difference in training outcomes what the delivery system preferences are?

Briefly, the results are that the adult trainees in these studies consistently preferred instructor-directed delivery. Self-directed learning methodologies were the least desirable for all groups. However, there may be a tendency for the younger, more highly educated to regard these procedures in a slightly more favorable light.

In addition, attitudes towards the various delivery systems do appear to play a role in influencing a range of training outcomes. The pattern appears with respect to knowledge retention and application of general behaviors on the job; the pattern is varied in relation to facilitating attitude changes. Learners' attitudes towards delivery systems, in turn, are determined (in this research) by a complex interaction of more general attitudes toward past training, their perceptions of the organizational climate in which they work, and their own experiences.

Adult Learner Delivery System Preferences

Data were gathered on the extent to which the trainees enjoyed five different delivery systems, as well as which of those techniques were liked most and least. The methodologies considered included two group-oriented (or instructor-directed), and three individualized (or individual-directed) plans. They were:

TABLE 1
A Comparison of Characteristics of ECPL Trainees from Group Instruction and Interactive Video Instruction Programs

Characteristic	Group Instruction N	Group Instruction %	Interactive Video Instruction N	Interactive Video Instruction %
Gender				
Male	355	93.4	26	76.5
Female	25	6.6	8	23.5
Age				
25 and under	3	0.8	11	32.4
26 - 35	77	19.8	12	35.3
36 - 45	153	39.6	8	23.5
46 - 55	101	26.0	3	8.8
56 and over	50	12.9	0	0.0
Education				
Less than High School	62	15.9	3	8.8
High School	109	28.0	3	8.8
Trade School/Some College	171	44.0	8	23.5
College Degree or more	34	8.7	20	58.8
Years on Present Job				
0 - 5	176	45.2	31	91.2
6 - 10	57	14.7	1	2.9
11 - 15	48	12.0	1	2.9
16 - 20	40	10.3	0	0.0
21 and over	60	15.4	1	2.9
Years at Ford				
0 - 5	17	4.4	26	76.5
6 - 10	26	6.8	0	0.0
11 - 15	83	21.7	6	17.6
16 - 20	82	21.4	2	5.9
21 and over	175	45.7	0	0.0
Total Trainees	**389**	**100.0**	**34**	**100.0**

TABLE 2
A Comparison of PMHV Operator and Pedestrian Trainee Characteristics Using Pre-test Data

Characteristic	Operator N	Operator %	Pedestrian N	Pedestrian %
Gender				
Male	310	99.4	152	77.9
Female	2	0.6	43	22.1
Age				
35 and under	19	6.3	28	14.1
36 - 46	132	43.6	78	39.4
46 - 55	119	39.3	69	34.8
56 and over	33	10.9	23	11.6
Education				
Less than High School	39	13.0	21	10.8
High School	130	43.2	93	47.9
Trade School/Some College	122	40.5	74	38.1
College Degree or More	10	3.3	6	3.1
Job Category				
Non-Production	99	32.1	15	7.7
Production	68	22.1	165	84.2
Maintenance	90	29.2	5	2.6
Supervisor	16	5.2	4	2.0
Other	35	11.4	7	3.6
Years on Present Job				
0 - 5	91	29.2	119	60.4
6 - 10	35	11.2	25	12.7
11 - 15	60	19.2	9	4.6
16 - 20	54	17.3	12	6.1
21 and over	72	23.1	32	16.2
Years at Ford				
0 - 5	6	1.9	28	14.0
6 - 10	3	1.0	4	2.0
11 - 15	32	10.3	8	4.0
16 - 20	79	25.3	43	21.5
21 and over	192	61.5	117	58.5
Total Trainees	317	100.0	201	100.0

- lecture and discussion,
- instructor led with videotape support,
- individualized instruction by a computer, (In one study differences were noted between computerized instruction with video—interactive videodisc—and computerized instruction without video support.)
- self-instructional workbooks.

Three of these delivery systems were used to some extent in the safety training related to energy control and power lockout, plant truck operator safety, and plant pedestrian safety. In the fourth study, training was delivered via interactive videodisc. There was no group-directed delivery system used in this training program.

The populations for the first three studies were comparable, except that there were essentially no females among the truck operators. The groups consisted primarily of hourly employees with a great deal of experience (nearly 20 years) with the company. There was less experience in their current positions, although it still averaged over 10 years. Most had some post-high school formal education. See Tables 1 and 2.

The preliminary data from the last study shows trainees who were younger (most were between 25 and 35), more highly educated (most have college degrees), and essentially all were new to their jobs, with the great majority new to the company. See Table 2.

Table 3 and Figure 3 show the comparisons among these groups in terms of their mean reactions to questions of the extent to which they enjoyed learning with the various delivery systems. Lecture/discussion was rated the most favorably in this measure; although learning with an instructor supported by videotape is also highly regarded. Individual-directed deliveries received the lowest ratings with the very lowest spot held by computer-based instruction, without integrated video. (The number of respondents reflects only those who indicated they had experienced the various delivery patterns.)

The preference for instructor-directed over individual-directed delivery is even more pronounced in Table 4 and Figures 4 - 7. These data were rankings—the systems liked best and least. However, in this context the system preferred by each group was the instructor with videotape. In this table it is clear that more ECPL/IVD trainees liked computerized instruction with video best than in the other three samples.

With respect to negative opinions, the first three groups clearly liked workbook self-instruction the least. For the ECPL/IVD group an equal number disliked the workbook and interactive videodisc. There are very mixed reactions to IVD instruction in this latter group. (Note: All preference data was collected before training.)

These preferences served as a key part of the model which was constructed to describe the effects of the delivery system attitudes on training outcomes.

A Model of the Effects of Delivery System Attitudes on Training Outcomes

An Overview of the Model. Figure 8 is a generalized path diagram which summarizes the replicated findings of this research. It represents conclusions derived from six validated path diagrams produced from the first three studies in this research. These paths relate to a range of training outcomes—knowledge retention, attitude change, and general application of the training content to on-the-job practices. The specific application of the skills and knowledge presented in the various training programs did not appear to be affected by trainees' delivery system preferences.

One general model, rather than one for each type of outcome, is being suggested here because the networks of causal

TABLE 3
A Comparison of Trainee Initial Attitude Toward Instructional Techniques

Instructional Technique	PMHV Operator			PMHV Pedestrian		
	N	$\bar{x}_1$	$\bar{x}_2$	N	$\bar{x}_1$	$\bar{x}_2$
Instructor-Directed						
Lecture/Discussion	257	1.914	3.086	162	1.969	3.031
Instructor/Videotape	266	1.992	3.008	154	2.058	2.942
Individual-Directed						
Computerized Instruction	194	2.650	2.350	115	2.652	2.348
Workbook Self-Instruction	250	2.684	2.316	159	2.572	2.428

$\bar{x}_1$ = Original mean
1 = Most desireable response

$\bar{x}_2$ = Converted mean
5 = Most desireable response

TABLE 3 (Continued)
A Comparison of Trainee Initial Attitude Toward Instructional Techniques

Instructional Technique	ECPL/IVD			Total Sample		
	N	$\bar{x}_1$	$\bar{x}_2$	N	$\bar{x}_1$	$\bar{x}_2$
Instructor-Directed						
Lecture/Discussion	33	1.70	3.30	452	1.886	3.114
Instructor/Videotape	30	2.00	3.00	450	2.016	2.984
Individual-Directed						
Computerized Instruction	—	—	—	309	2.654	2.346
Computer Instr/Video	23	2.39	2.61	23	2.390	2.610
Computer Instr/No Video	20	3.10	1.90	20	3.100	1.900
Workbook Self-Instruction	28	2.32	2.68	437	2.601	2.399

$\bar{x}_1$ = Original mean
1 = Most desireable response

$\bar{x}_2$ = Converted mean
5 = Most desireable response

FIGURE 3
A Graphical Comparison of Trainee Initial Attitude Toward Instructional Techniques

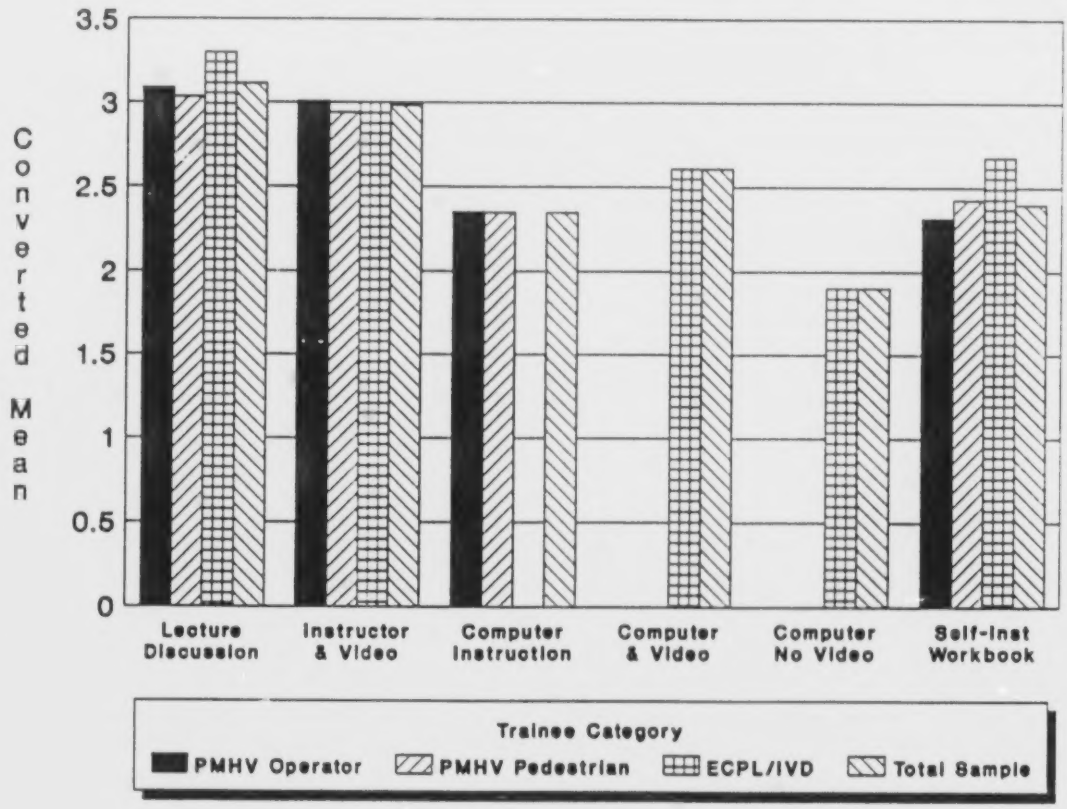


TABLE 4
A Comparison of Trainee Instructional Technique Preferences

Instructional Technique	PMHV Operator				PMHV Pedestrian			
	Liked Best		Liked Least		Liked Best		Liked Least	
	N	%	N	%	N	%	N	%
Instructor-Directed								
Lecture/Discussion	97	32.8	32	11.0	73	39.9	31	16.9
Instructor/Videotape	168	56.8	34	11.6	89	48.6	21	11.5
Individual-Directed								
Computerized Instruction	14	4.7	80	27.4	5	2.7	48	26.2
Workbook Self-Instruction	17	5.7	146	50.0	16	8.7	83	45.4
Total Sample	**296**	**100.0**	**292**	**100.0**	**183**	**100.0**	**183**	**100.0**

TABLE 4 (Continued)
A Comparison of Trainee Instructional Technique Preferences

Instructional Technique	ECPL				ECPL/IVD			
	Liked Best		Liked Least		Liked Best		Liked Least	
	N	%	N	%	N	%	N	%
Instructor-Directed								
Lecture/Discussion	59	21.3	22	7.5	5	18.5	5	14.7
Instructor/Videotape	188	67.9	23	8.3	13	48.1	10	29.4
Individual-Directed								
Computerized Instruction	24	8.7	62	22.4	—	—	—	—
Computer Instr/Video	—	—	—	—	6	22.2	9	26.5
Comp. Instr/No Video	—	—	—	—	3	11.1	1	2.9
Workbook Self-Instruction	6	2.2	188	63.7	0	0.0	9	26.5
Total Sample	**277**	**100.0**	**295**	**100.0**	**27**	**100.0**	**34**	**100.0**

FIGURE 4
A Graphical Comparison of Trainee Most Preferred Instructional Techniques

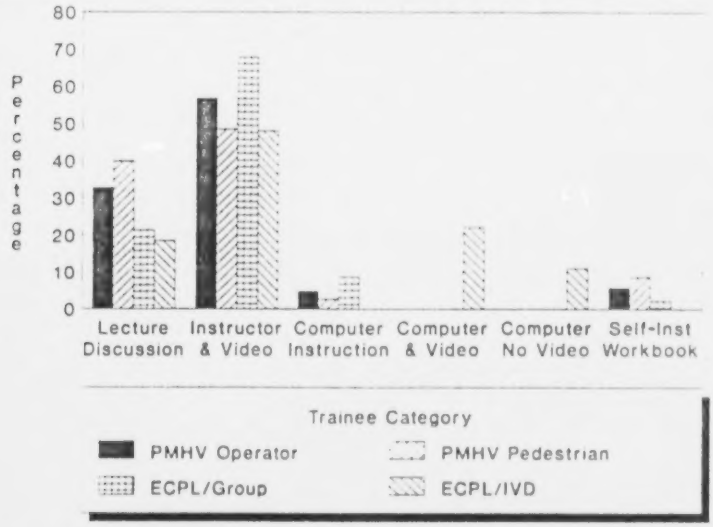


FIGURE 5
A Graphical Comparison of Trainee Least Preferred Instructional Techniques

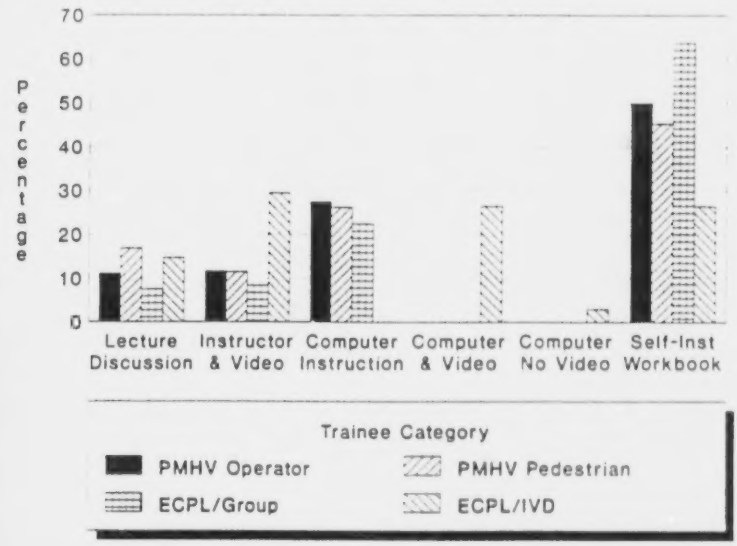


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FIGURE 6
Trainee Delivery System Rankings
Most Preferred Methods (N = 783)

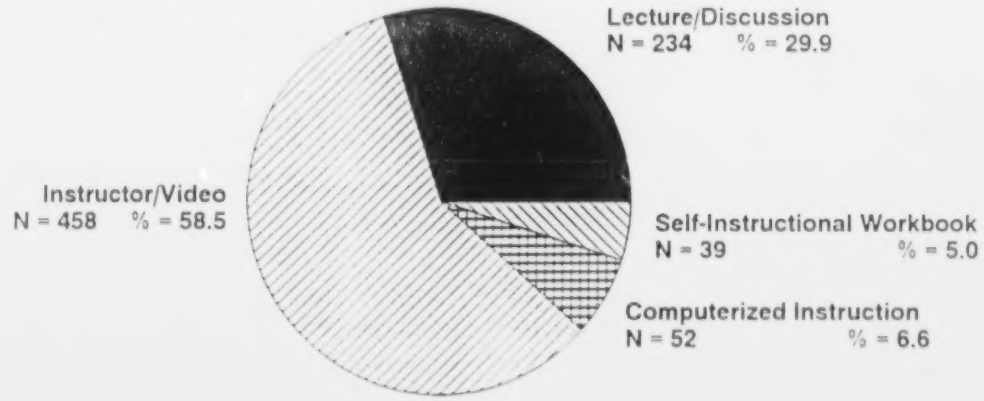


FIGURE 7
Trainee Delivery System Rankings
Least Preferred Methods (N= 804)

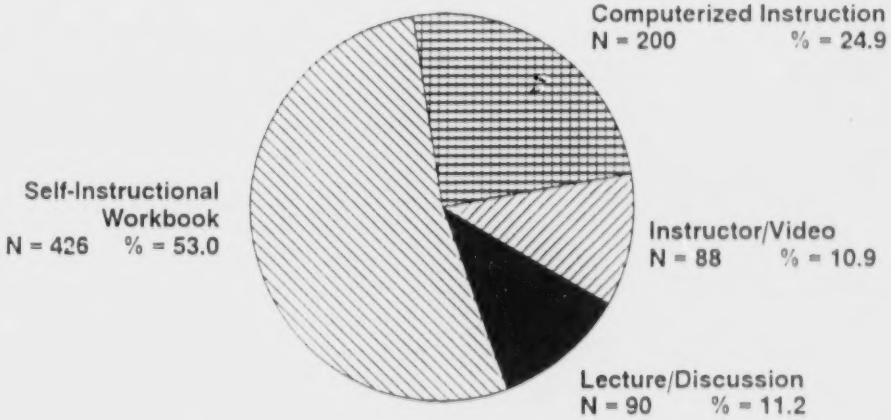
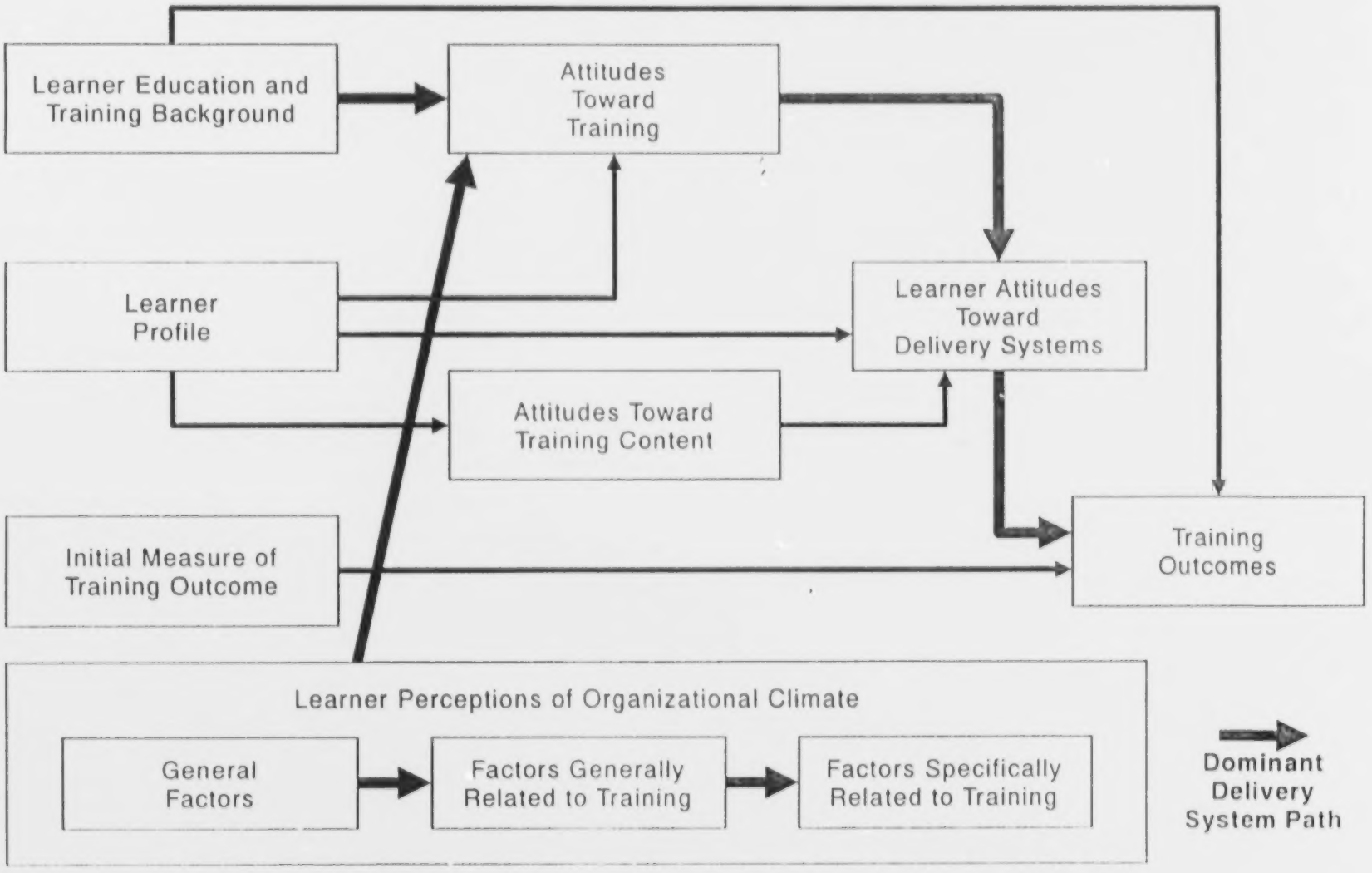


Figure 8
A General Model of Delivery System Variables Contributing to Training Outcomes



relationships did not seem to consistently vary in terms of training outcome. This model reflects all relationships produced by the data. However, the general model's dominant path highlights those relationships which were replicated more frequently in the separate studies.

Appendix B presents the six path diagrams upon which the general model is based. (See Figures 9 - 14.) Each of these diagrams also have dominant paths presented. Rather than representing the dominant path for that particular data set, this path shows the connections between that particular diagram and the general causal model presented in Figure 5. In addition, those measures which relate directly or indirectly to delivery system preferences have been shaded. Finally, Tables 5 - 10 present the data supporting the path diagrams in Figures 9 - 14. The measures in these diagrams match those variables listed in Appendix A.

The array of variables tested in these studies explained from 41% to 80% of the variance in the three categories of training outcomes. On the average, sixty per cent of the outcomes of these training programs can be predicted by the adult learners' entering characteristics and perceptions, most of which are directly or indirectly related to one's perceptions of the training delivery system. The factors included in the final model include:

- Initial Measure of Training Outcome,
- Perceptions of the Organizational Climate,
- Education and Training Background,
- Profile Characteristics,
- Attitudes Toward Training and the Training Content, and
- The Learner's Attitudes Toward Delivery Systems.

The Role of One's Entering Performance Level. A standard research conclusion is the best predictor of future performance is past performance. Such findings were consistent in this research. Therefore, the pre-training measure of the given outcome had the greatest influence on the gains. For example, the entering knowledge level predicted the knowledge gain; the initial safety attitude predicted the gains in safety attitudes; the behaviors demonstrated on the job prior to training predicted the changes in behavior after training.

The nature of the relationship between past and future performances, however, varies dependent upon the type of training outcome. With respect to the knowledge outcome, the relationship was expected. Those who entered training with a lower knowledge level, i.e. those with the most to gain, did demonstrate the greatest gains. For attitude and behavior changes, the pattern is reversed. Those with the highest initial measures were the more likely to demonstrate the larger gains. In other words, one apparently must have somewhat positive attitudes to begin with to be receptive to further attitude changes; and, one must already demonstrate some of the desired behaviors to be more likely to transfer training principles to the job situation. Unlike knowledge outcomes, those with the most to gain seem to be the least likely to be responsive to training. This finding was consistently replicated in the three studies.

The initial performance measure was always the major factor which determined the training outcome, accounting for the majority of the variance in the outcome measure. However, this relationship is not part of the dominant path of variables showing the relationships between adult delivery system attitudes and the major types of training outcomes. The following discussion is of those variables which do play a role in these relationships.

Learner Attitudes Toward Training Delivery. The learners' perceptions of the delivery system seem to affect more than whether they're pleased with the training; they contribute to the overall effects of the

training programs. In general, if adults enjoy learning in the manner in which their training is primarily delivered, they will learn more and will be more likely to make a general transfer of the training content to their jobs. (See Figure 9 - ECPL Knowledge, Figure 10 - Pedestrian Knowledge, and Figure 13 - Pedestrian Behavior for support of this conclusion.) At times, an alternative, but supportive deduction can also be made. Disliking alternative training delivery system can also contribute to knowledge and behavior gains. (See Figure 10 - Pedestrian Knowledge and Figure 14 - Operator Behavior.) Learner perceptions of training delivery systems appear to have no effect on transferring specific skills and knowledge to the workplace.

While there are effects with respect to attitude change, a very different pattern was evident. Here disliking the primary delivery system (See Figure 12 - Operator Attitude), and liking a very different delivery system (See Figure 11 - Pedestrian Attitude) seem to contribute to gains in the desirable attitude. It may be that attitudes require an instructional methodology which facilitates more introspection than is likely with group-oriented techniques.

Attitudes Towards Training and the Trainee's Education and Training Background. There were three measures of one's attitudes towards training: Enjoying Past Training Programs, Would Volunteer for More Training, and Found Past Training Information Useful. These factors, indicative of a training motivation level, explained to a great extent the trainee's current attitudes towards the training delivery system. The relationship between attitude toward training and attitude toward delivery system is present in five of the six path diagrams. "Enjoyed past training programs" is present in each. (Only Figure 9 - ECPL Knowledge does not support this conclusion.)

The instructor/videotape format has been used frequently in the training at this corporation. Therefore, it speaks well of the training that the positive attitudes are predicted by the amount of employee training that the learners had experienced. In this context, more training leads to positive attitudes towards the experiences and, in turn, towards the delivery systems used. (See Figure 10, 11, and 13 - the three Pedestrian diagrams.) In Figure 9 - ECPL Knowledge - the amount of previous training directly influences the delivery system attitude. Level of formal education does not have the same effects consistently as amount of training. (See Figure 11 - Pedestrian Attitude and Figure 14 - Operator Behavior.)

Perceptions of Organizational Climate. The trainees' perceptions of the organizational climate directly influence their attitudes towards training. This relationship was evident in every case, except one. (See Figures 10 -14.) Three levels of organizational climate measures are included in this research: general climate measures, measures generally related to the training content (i.e. safety factors), and measures specifically related to the training content. The relationships between these levels of climate and training outcomes has previously been established (Richey, 1990); this research relates perceptions of climate to the delivery system attitudes as well. Mostly, the perceptions of general organizational climate influence attitudes towards past training; however, the other two categories share a role in determining such attitudes, as well. These relationships are evident in each supporting path diagram.

The most important factors related to employee perceptions of management actions. Eight variables influenced delivery attitudes either directly, or most frequently, indirectly. The two variables most commonly included in the various supporting path diagrams were "Supervisor's rating" and "Union/management support specific safetyrules".

The next most important categories of variables related to employee empowerment and physical working conditions, each having eighteen separate paths among the six diagrams. These two areas contained the most frequently significant variables in all of the paths. These were "Decision involvement" and "Satisfaction with physical working conditions".

A final category included fourteen paths that concerned the influence of collegial relationships. "Co-workers cooperate" and "Co-workers support safety" were the most important. Perceptions of the quality of work also influenced delivery system attitudes indirectly five times.

Learner Characteristics. Five other learner profile characteristics played an important role in explaining delivery system attitudes. Because all training programs involved health and safety issues, the prospective trainee's accident experience was assessed. The amount of accident experience seemed to promote negative attitudes towards the primary delivery system; although in one case (Figure 12 - Operator Attitude) it did relate to more enjoyment of past training.

Age and factors related to years of service were also influential. Older trainees were more likely to enjoy the instructor/videotape delivery method. (See Figure 10 - Pedestrian Knowledge and Figure 13 - Pedestrian Behavior.) Figure 10 also indicates that older workers tend to like individualized instruction by computer, which one typically would not expect. However there are conflicting signals with this diagram; it also specifies that those with more years of experience at the company tend to like computerized instruction less.

In other situations the older workers tend to have a better initial attitude toward safety. (See Figure 9 - ECPL Knowledge and Figure 11 - Pedestrian Attitude relating more years on the job to better safety attitudes.) On the other hand, the trainees with fewer years on their current jobs seemed to have a better attitude toward training in one training situation. (See Figure 14 - Operator Behavior.)

In the situation in which gender was significant, the females were more likely to enjoy learning with an instructor and videotape. (See Figures 10 and 13 - Pedestrian Knowledge and Behavior.)

Learner Attitudes Toward Training Content. The initial attitude towards safety, the general topic in each training program, influenced delivery system attitudes directly in two cases. (See Figure 9 - ECPL Knowledge and Figure 11 - Pedestrian Attitude.) However, in one instance there was a positive relationship, and it was negative in the other. No conclusive result can be determined.

DISCUSSION

This research indicates that adult attitudes towards training and the ways in which training programs are conducted do influence the fundamental success or failure of these programs, not only in terms of how much is learned, but also with respect to a generalized transfer of training principles to the workplace. A model of those factors which contribute to these training outcomes has been constructed and described. These findings have implications for

- understanding adult learning in employee training settings,
- refining the instructional design process with a more systemic orientation, and
- enhancing approaches to selecting media and learning activities.

Delivery System Preferences and Adult Learning in Employee Training

The Role of Preferences. There has been evidence that for children "student enjoyment of instructional media and their

subsequent achievement were negatively correlated" (Clark and Salomon, 1986, p. 473). This appears to be a case in which adult learning patterns differ, at least in employee training situations. In the training programs studied here such enjoyment does influence achievement in both the traditional sense of knowledge acquisition, as well as in a broader definition of desired training outcomes. If these preferences are more important than being only a source of satisfaction, the question of identifying the most desirable adult delivery methodology becomes more critical.

Age and Eduction Effects. In these replicated studies, the trainees consistently prefer group instruction which is instructor-directed. This has been explained previously as an age and education-related finding. Long (1983) found that learners under 24 years of age preferred learning with peers, through direct experience, and using iconic devices. Those over 24 preferred the traditional class organization, listening and reading activities, and detailed explanations. This is not a very useful age distinction to apply to employee training, since the vast majority of trainees are over 24. The subjects of this research included 10% past the age of 55.

Knox (1977) has previously described general conclusions relating to approaches to adult learning which still have credence today. He cites the importance of one's formal preparatory educational experiences as a primary inhibitor or facilitator of adult learning. Younger adults tend to be more highly educated, and thus have had success with traditional delivery patterns. He also cites the influence of recent similar learning activities on delivery preferences.

An examination of the current findings in terms of age and education level, do not change the conclusions with respect to delivery preferences. In general, all groups preferred instructor-directed delivery. The ECPL trainees had a larger number of supervisory employees, most of whom were older, and had a higher level of formal education. An examination of the salaried employees showed little difference in their preferences when compared to hourly employees in the original set of ECPL trainees. The supervisors favored instructor with videotape support methods somewhat more than traditional lectures than did the hourly employee group.

The small preliminary set of data from the ECPL interactive-videodisc training showed employees who were very young and highly educated. They, too, preferred group instruction, but almost 25% liked IVD instruction best. This may reflect a change in current learners under 25 who have had more computer experience both in schools and the home. However, this research does not support attributing particular delivery system preferences to a given age group, or to those with a certain education level. In fact, similar preferences were identified with a population primarily of corporate managers most with engineering backgrounds (Bellinger, 1991).

Delivery System Preference and Motivation Level. Knox's (1977) emphasis on recent educational experiences may be more reflective of these results. The delivery preferences here are influenced by learners' reactions to previous training experiences, as well as the general atmosphere in their workplaces. Instructors with videotape support are used frequently in this corporation's safety training, a typical practice in large American corporations. The influence of delivery system preferences and attitudes towards past training may be an expression of the trainee's motivation level.

Typically, trainers and instructional designers motivation concerns focus on increasing the appeal of the instruction. Perhaps motivation is more closely tied to training effects. Keller (1988) has described three key approaches to incorporating motivation into instructional designs. These are person-centered, environmentally

centered, and interaction-centered models. In many respects the delivery system causal model presented here represents a combination of these three approaches.

Fundamental emphasis is placed upon the personal motives and opinions of the trainee, but these attitudes are closely tied to environmental characteristics and reinforcement within the work setting. Finally, the overwhelming indication of preferences for class-based training over individually directed learning speaks to the power of a social learning context.

The missing link in this research design was a measure of preference for group-directed delivery systems. Clearly, many adult educators would feel that these attitudes could be even more positive than for the other two approaches. Such a finding would provide additional support for an interaction-centered model of motivation design.

Implications for Instructional Design

Most instructional designers are guided on a macro-level by the systems approach and on a micro-level by principles of cognitive psychology. Their work is grounded in a belief that "good design" can produce substantial learning, counterbalancing the effects of other inhibiting factors. The essence of mastery learning is faith that process, instruction and the management of instruction, can compensate for individual learner differences. The model proposed in this research says two things to the designer:

- A wide range of integrated variables affect the learning process; thus, one should consider a systemic as well as a systematic approach.
- Instructional processes may account for less than half of training outcomes.

Even as the use of instructional systems design principles is growing within the corporate training setting, others are looking ahead and becoming concerned with the effects of what they see as a blinding adherence only to procedural design models as the predominant, and often sole, guide for course and program development. Winn (1989) argues for reasoning "from basic principles of learning and instruction rather than simply following design models" (p. 36). Davies (1984) sees that the emphasis on systematic methods has resulted in a "tendency to freeze methodologies and techniques in a fixed form ... the 'one best way' approach has often reduced creative ideas to cookbook-like recipes, and promising heuristics to algorithms" (p. 9).

The model presented here shows a network of integrated variables which directly and indirectly affect training outcomes. The model does not address design process variables, such as use of feedback, effects of performance objectives, sequencing patterns, use of examples and non-examples. The model does not address delivery concerns, such as questioning techniques, reinforcement, or effects of color. While a body of literature shows the importance of factors such as these, the current research is most likely saying that those variables, even a combination of those variables, are probably not enough to explain adult learning in the workplace.

Organizational climate, one's work history, past training experiences, and delivery system attitudes account for as much knowledge retention as do formal design factors. These additional factors affect cognitive processing and are instrumental in shaping behavior on the job. While designers can say such factors are out of their control, it is difficult to ignore them when faced with the report that entry characteristics may determine up to 80% of the outcomes of training, leaving process (instruction and instructional materials) responsible for only 20% of the variance.

Delivery system preferences need to be cultivated prior to instruction in that format, especially if the methodology may be new.

This step needs to be incorporated into the instructional sequence. Its inclusion may be especially important in employee training situations with standardized delivery which allows few possibilities for trainer intervention.

Implications for Selecting Media and Delivery Methods

Modifying Current Media Selection Models. These results also have implications for selecting media and delivery systems. Reiser and Gagne (1983) present a media selection model based upon the objectives to be taught, the domain of learning to which each objective belongs, the instructional setting, and data on students' reading level. Their model systematically presents those factors typically recommended in the selection process. This research indicates that for employee training, one should also consider:

- learner attitudes towards past training and delivery systems, as well as learner abilities;
- learner related work experience and educational profiles, and
- organizational climate characteristics, as as the physical characteristics of the learning environment.

In essence, this means placing equal emphasis on learner characteristics as the model now places on content demands, media attributes, and practical considerations. For designers, this can be particularly difficult when dealing with the extreme diversity of most adult populations.

An interesting feature from one study was the fact that the older trainees liked group instruction with videotape more than lecture. The media attitudes seemed to promote both knowledge retention and behavior changes for this group. Perhaps the added properties of video creates not only a more motivating setting, but also one which highlights the information to be learned for those trainees who typically have been away from formal learning situations for some time. Younger employees, more recently in educational settings, may not need these cues.

Delivery System Selection. Romiszowski (1988) highlights the primary role of instructional methods in determining media. Delivery systems are selected first, and in turn influence media selection. A clear and replicated finding of this research relates preferred delivery with training success. However, it seems inappropriate to conclude that only familiar, well-liked delivery systems should be selected in all situations. Rather, it seems more advantageous to consider instructional interventions if new delivery systems or media are warranted.

The problems are exacerbated when considering the use of the new technologies. At times these decisions are blends of selecting both delivery system and media. Now, designers are likely to face situations with antagonistic elements: the technology is often cost effective, but the learners (and possibly the training facilitators) have had little experience with the media, or with individually directed training. Technology advantages will need to be weighed against the extra efforts needed to ensure success.

CONCLUSION

This research has produced and replicated a model showing the role attitudes toward delivery systems play in industrial training. For the most part the original hypotheses were supported. There were two areas which deviated from the original Figure 2 model. First, trainee attitudes towards their jobs do not relate to delivery system attitudes as anticipated, even though perceptions of the organizational climate play a major role. Second, delivery system preferences relate to on-the-job application of knowledge generally, but not specifically, related to the training.

The proposed causal model is complex, one which demands that designers have a thorough knowledge of their target population. It is a model which is unique in this form to employee training, rather than all adult learning environments. However, it is a model that could be useful because it was derived from real training programs with a range of typical employees. It is a model that discusses adult learning based upon empirical data, rather than only experience and hypothesis. And, as with most other research, it is a model which poses as many new questions as it answers.

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APPENDIX A

MEASUREMENT OF VARIABLES

All measures listed below were used in each of the four studies unless otherwise noted. The following key relates those unique variables to the appropriate study:

* Energy Control and Power Lockout Safety Training/Group

** Energy Control and Power Lockout Safety Training/IVD

\# Plant Pedestrian Safety Training

\#\# Truck Operator Safety Training

Only measures included on path diagrams are listed.

EXOGENOUS VARIABLES

Learner Demographic Profile Characteristics

1. Age. In years.
2. Gender. A dummy variable, 1 = male; 2 = female.
3. Education level. 1-5 graduated levels.
4. Amount of previous training. *1-5 graduated levels; **,#, and ## 1-6 graduated levels.

Learner Work Experience Characteristics

1. Years on present job. 1-5 graduated levels.
2. Years employed by company. 1-5 graduated levels.
3. Accident Experience. *1 = yes; 2 = no. **,#, and ## 1= none; 2 = known someone in accident; 3 = minor accident; 4 = major accident.

General Organizational Climate Characteristics

Employee Perceptions of Management Actions

1.Supervisor's rating. 1-5 Very good to very poor.

Employee Empowerment

1. Involvement in decision making. 1-5 Very satisfied to very dissatisfied.
2. Encouraged to devise new work methods. 1-5 Strongly agree to strongly disagree.

Collegial Relationships

1. Co-workers cooperate. 1-5 Strongly agree to strongly disagree.

Physical Conditions

1. Physical working conditions. 1-5 Strongly agree to strongly disagree.
2. Conditions promote productivity. 1-5 Strongly agree to strongly disagree.

Quality of Work

1. Quality of work. 1-5 Strongly agree to strongly disagree.

ENDOGENOUS VARIABLES

Learner Attitudes

1. Job satisfaction.1-5 Strongly agree to strongly disagree.
2. Safety attitude. 1-5 Strongly agree to strongly disagree.

Attitude Toward Training

1. Volunteer for other training. 1-5 Strongly agree to strongly disagree. (#. ##, and **); A dummy variable 0 = no 1 = yes *
2. Information from past training useful. 1-5 Strongly agree to strongly disagree. (#. ##, and **); A dummy variable 0 = no 1 = yes *
3. Enjoy past training. 1-5 Strongly agree to strongly disagree. (#. ##, and **); A dummy variable 0 = no 1 = yes *

Organizational Climate Generally Related to Training

Employee Perceptions of Management Actions

1. Operation more important than safety. 1-5 Strongly agree to strongly disagree. 5 = most desirable (# and ##)
2. Plant manager aware of safety issues. 1-5 Strongly agree to strongly disagree.
3. Union/management support safety. 1-5 Strongly agree to strongly disagree.
4. Supervisor corrects safety hazards quickly. 1-5 Strongly agree to strongly disagree.
5. Safety top plant priority. 1-5 Strongly agree to strongly disagree.

Collegial Relationships

1. Co-workers support safety. 1-5 Strongly agree to strongly disagree.

Organizational Climate Specifically Related to Training

Employee Perceptions of Management Actions

1. Union/management support lockout/truck operator/pedestrian safety rules. 1-5 Strongly agree to strongly disagree.
2. Accountable for not following lockout/truck operator/pedestrian safety rules. 1-5 Strongly agree to strongly disagree.
3. Lockout not a common practice.1-5 Strongly agree to strongly disagree. (* and **)

Collegial Relationships

1. Pedestrians/Truck operators follow safety rules. 1-5 Strongly agree to strongly disagree. (# and ##)

Physical Conditions

1. Shortage of locks.1-5 Strongly agree to strongly disagree. (* and **)
2. Impossible to lockout on my job. 1-5 Strongly agree to strongly disagree. (* and **)

Learner Attitudes Toward Delivery System

1. Like learning with instructor/videotape best. A dummy variable. 0=no 1=yes
2. Enjoy learning with instructor/videotape. 0=Never experienced 1-5 Strongly agree to strongly disagree. (#,##, and **)
3. Enjoy learning with lecture/discussion. 0 = Never experienced 1-5 Strongly agree to strongly disagree. (#,##, and **)
4. Enjoy learning with self-instructional workbook. 0=Never experienced 1-5 Strongly agree to strongly disagree. (#,##, and **)
5. Enjoy learning with individualized instruction with computer. 0 = Never experienced 1-5 Strongly agree to strongly disagree. (#, and ##)

DEPENDENT VARIABLES

1. Gains in Knowledge Retention. The pre-test/post-test differences between the sums of the correct answers of those objective test items covering training content. (ECPL group and interactive video, 23 items; Truck Operator, 25 items; Plant Pedestrian, 14 items)

2. Gains in Attitude Towards Safety. The pre-test/post-test differences between the measure "The safety risks of my job concern me quite a bit."

3. Gains in General On-the-Job Safety Behavior. The pre-test/post-test differences between the measure "Before starting a job, how often do you consciously evaluate the consequences of not doing the job safely?"# and "How do you rate your safety performance?"##

APPENDIX B

PATH DIAGRAMS SUPPORTING GENERAL MODEL OF DELIVERY SYSTEM PREFERENCE EFFECTS

Figure 9 - ECPL Knowledge - Page 27

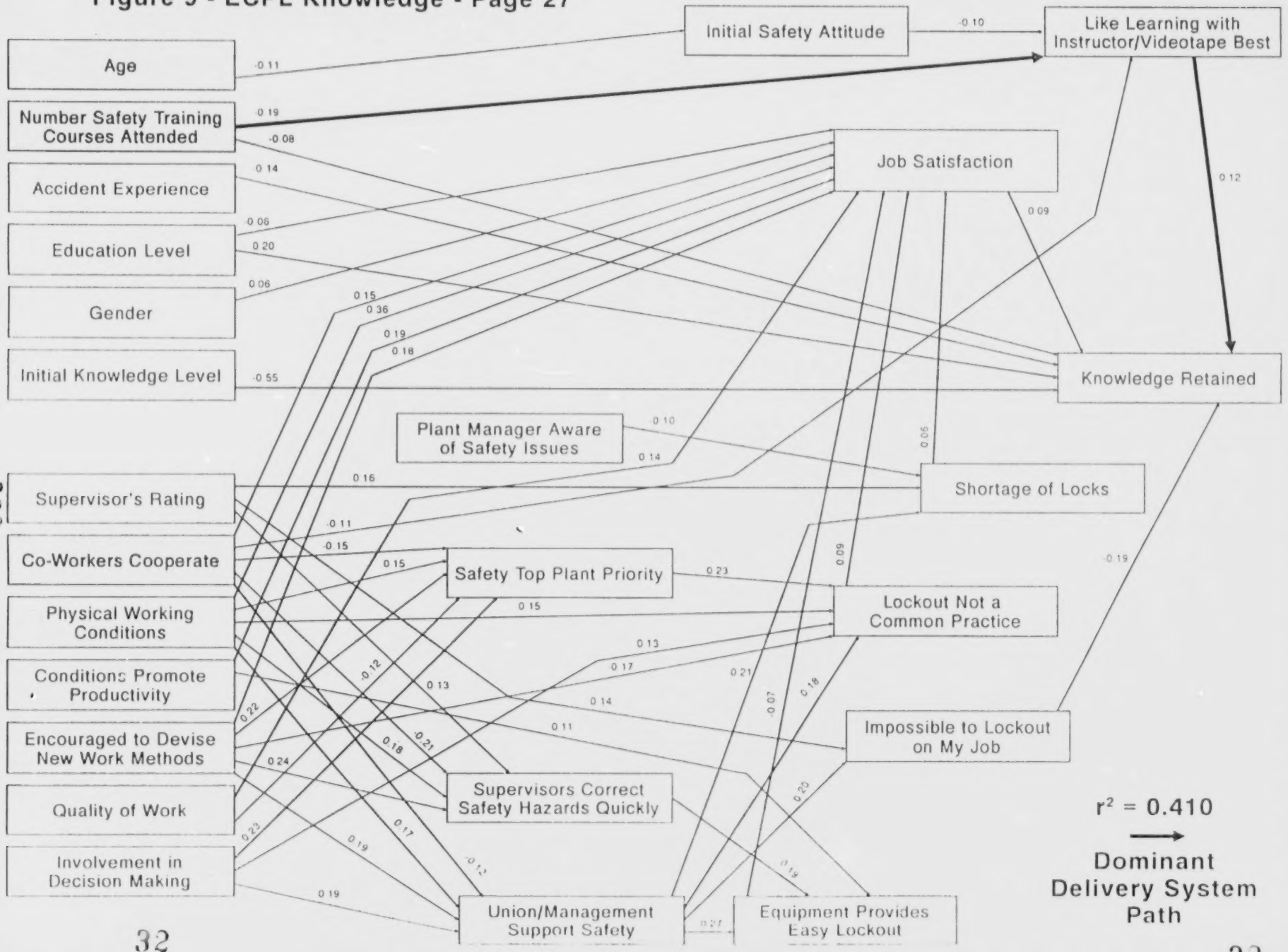

TABLE 5
Hypothesized Effects of Delivery System Preferences on Training Knowledge Retention (ECPL Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Liked Learning with Instructor/ Videotape Best	Constant	0.768	0.067		
	Number of Programs	-0.025	0.007	-3.830	➡0.000+
	Rating of Self	-0.036	0.017	-2.189	➡0.029
	Mutual Safety Attitude	-0.054	0.028	-1.927	0.054
	r^2 = 0.068		N = 388		
Job Satisfaction Mean = 2.15 S.D. = 1.27	Constant	0.052	0.247		
	Physical Conditions	0.310	0.036	8.707	➡0.000+
	Conditions Promote	0.160	0.040	4.017	➡0.000+
	Co-workers Cooperate	0.147	0.040	3.683	➡0.000+
	Encouraged to Devise	0.187	0.040	4.690	➡0.000+
	Quality of Work	0.104	0.033	3.162	➡0.002
	Lockout Not Common	0.068	0.029	2.327	➡0.021
	Easy to Lockout	-0.091	0.038	-2.392	➡0.017
	Educational Level	-0.056	0.025	-2.231	➡0.026
	Gender	0.212	0.113	1.876	0.062
	Lockout Shortage	0.036	0.021	1.706	0.086
	Age	-0.064	0.039	-1.644	0.101
	r^2 = 0.657		N = 381		
Initial Safety Attitude Mean = 1.51 S.D. = 0.88	Constant	1.850	0.163		
	Age	-0.110	0.047	-2.149	➡0.032
	r^2 = 0.012		N = 381		
Impossible to Lockout on My Job Mean = 2.42 S.D. = 1.76	Constant	1.379	0.212		
	Union/Mgmt Support	0.322	0.081	3.956	➡0.000+
	Supervisor's Rating	0.177	0.065	2.719	➡0.007
	r^2 = 0.070		N = 388		
Lockout Not Common Practice Mean = 2.52 S.D. = 1.31	Constant	1.296	0.159		
	Safety Top Priority	0.238	0.059	4.074	➡0.000+
	Union/Mgmt Support	0.212	0.070	3.052	➡0.002
	Physical Conditions	0.149	0.053	2.642	➡0.009
	Encouraged to Devise	-0.162	0.058	-2.787	➡0.006
	Decision Involvement	0.112	0.050	2.270	➡0.024
	r^2 = 0.190		N = 388		

➡Significant at 0.05 level or less | ➡Significant at 0.01 level or less

TABLE 5 (Continued)
Hypothesized Effects of Delivery System Preferences on Training Knowledge Retention
(ECPL Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Lock Shortage	Constant	2.017	0.226		
	Union/Mgmt Support	0.335	0.082	4.071	➡0.000+
	Supervisor's Rating	0.203	0.065	3.103	➡0.002
Mean = 2.94	Plant Manger Aware	-0.120	0.061	-1.970	➥0.050
S.D. = 1.77	r^2 = 0.082		N= 388		
Equipment Provides Easy Lockout	Constant	1.261	0.124		
	Union/Mgmt Support	0.252	0.049	5.113	➡0.000+
	Supervisors Correct	0.172	0.046	3.722	➡0.000+
	Conditions Promote	0.077	0.035	2.228	➥0.026
Mean = 2.21					
S.D. = 1.03	r^2 = 0.171		N = 388		
Union/ Management Support Safety	Constant	1.145	0.122		
	Decision Involvement	0.133	0.041	3.231	➡0.001
	Encouraged to Devise	0.146	0.051	2.867	➡0.004
	Physical Conditions	0.139	0.048	2.812	➡0.005
	Co-workers Cooperate	-0.099	0.050	-1.985	➥0.048
Mean = 1.96					
S.D. = 1.09	r^2 = 0.160		N = 388		
Supervisors Correct Hazards Quickly	Constant	1.893	0.133		
	Encouraged to Devise	0.198	0.052	3.787	➡0.000+
	Physical Conditions	0.147	0.051	2.878	➡0.004
	Co-workers Cooperate	-0.194	0.056	-3.454	➡0.000+
	Supervisor's Rating	0.107	0.049	2.194	➥0.029
Mean = 2.56					
S.D. = 1.16	r^2 = 0.125		N = 388		
Safety Top Plant Priority	Constant	1.500	0.144		
	Decision Involvement	0.187	0.049	3.842	➡0.000+
	Encouraged to Devise	0.199	0.060	3.332	➡0.000+
	Quality of Work	-0.110	0.053	-2.059	➡0.040
	Physical Conditions	0.135	0.056	2.397	➥0.017
	Co-workers Cooperate	-.0146	0.062	-2.333	➥0.020
Mean = 2.26					
S.D. = 1.27	r^2 = 0.159		N = 388		

➥Significant at 0.05 level or less ➡Significant at 0.01 level or less

TABLE 5 (Continued)
Hypothesized Effects of Delivery System Preferences on Training Knowledge Retention
(ECPL Training)

Dependent Variable	Causal Variable	B	SE B	T	p
Gain in ECPL Knowledge Retained	Constant	15.199	1.638		
	Initial Knowledge Level	-1.038	0.088	-11.787	➨0.000+
	Educational Level	0.489	0.117	4.195	➨0.000+
	Lockout Impossible	-0.392	0.098	-3.977	➨0.000+
	Accident Experience	-0.528	0.180	-2.925	➨0.004
	Inst/Videotape Best	0.824	0.340	2.420	➨0.016
Mean = 2.48	Job Satisfaction	0.261	0.144	1.806	0.072
S.D. = 3.69	Number of Programs	-0.075	0.045	-1.680	0.094
	r^2 = 0.410		N = 283		

➨Significant at 0.05 level or less | ➨Significant at 0.01 level or less

TABLE 6
Hypothesized Effects of Delivery System Preferences on Training Knowledge Retention
(PMHV Pedestrian Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Enjoyed Learning with Instructor/ Videotape	Constant	0.269	0.354		
	Past Tng Info Useful	0.352	0.107	3.297	➡0.001
	Enjoyed Past Training	0.366	0.108	3.401	➡0.001
	Accident Experience	0.150	0.060	2.509	➡0.013
	Gender	-0.130	0.065	-2.011	➡0.046
Mean = 2.06	r^2 = 0.369		N = 138		
Enjoyed Learning with Individualized Instruction by Computer	Constant	1.304	0.440		
	Past Tng Info Useful	0.689	0.127	5.416	➡0.000+
	Accident Experience	0.229	0.090	2.538	➡0.013
	Age	-0.306	0.120	-2.547	➡0.012
	Years at Company	0.133	0.070	1.886	0.062
Mean = 2.65	r^2 = 0.295		N = 112		
Union/Mgmt Support Pedestrian Safety Rules	Constant	1.059	0.259		
	Safety Top Plant Priority	0.160	0.048	3.355	➡0.001
	Union/Mgmt Support	0.192	0.056	3.418	➡0.000+
	Operation Important	-0.153	0.050	-3.053	➡0.003
	Co-workers Support	0.165	0.055	2.974	➡0.003
Mean = 2.12 S.D. = 0.87	Quality of Work	0.126	0.058	2.178	➡0.030
	r^2 = 0.365		N = 187		
Safety Top Plant Priority	Constant	0.591	0.247		
	Decision Involvement	0.272	0.089	3.041	➡0.003
	Encouraged to Devise	0.298	0.084	3.543	➡0.001
	Supervisor's Rating	0.207	0.080	2.604	➡0.010
Mean = 2.50 S.D. = 1.26	r^2 = 0.265		N = 194		
Supervisors Correct Hazards Quickly	Constant	0.616	0.247		
	Supervisor's Rating	0.406	0.071	5.761	➡0.000+
	Physical Conditions	0.249	0.080	3.126	➡0.002
	Co-workers Cooperate	0.223	0.076	2.927	➡0.004
Mean = 2.82 S.D. = 1.21	r^2 = 0.324		N = 194		

➡Significant at 0.05 level or less | ➡Significant at 0.01 level or less

FIGURE 10 - Pedestrian Knowledge - Page 31

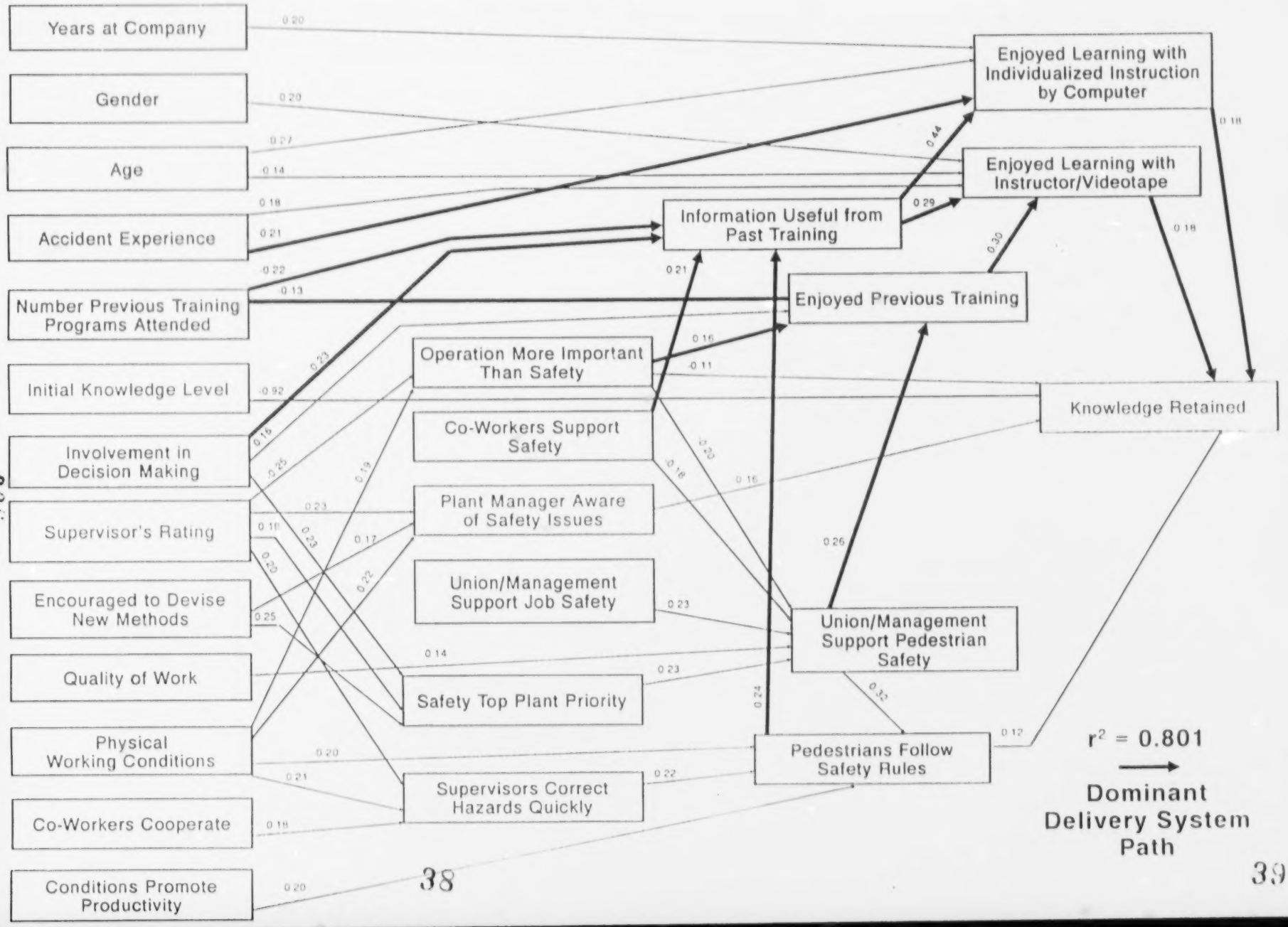

TABLE 6 (Continued)
Hypothesized Effects of Delivery System Preferences on Training Knowledge Retention
(PMHV Pedestrian Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Plant Mgr Aware of Safety Issues	Constant	0.785	0.256		
	Supervisor's Rating	0.233	0.075	3.105	➡0.002
	Physical Conditions	0.252	0.081	3.110	➡0.002
	Encouraged to Devise	0.191	0.075	2.527	➡0.012
Mean = 2.46 S.D. = 1.15	r^2 = 0.205		N = 190		
Enjoyed Past Training Programs	Constant	1.626	0.230		
	Programs Attended	-0.130	0.030	-4.340	➡0.000+
	Union/Mgmt Support	0.199	0.060	3.290	➡0.001
	Decision Involvement	0.101	0.045	2.239	➡0.026
	Operation Important	0.092	0.044	2.098	➡0.037
Mean = 2.12 S.D. = 0.69	r^2 = 0.169		N = 179		
Past Training Information Useful	Constant	1.279	0.190		
	Decision Involvement	0.142	0.044	3.219	➡0.002
	Co-workers Support	0.153	0.051	3.015	➡0.003
	Pedestrians Follow	0.145	0.044	3.298	➡0.001
	Number of Programs	-0.093	0.030	-3.120	➡0.002
Mean = 2.03 S.D. = 0.70	r^2 = 0.247		N = 164		
Pedestrians Follow Safety Rules	Constant	1.293	0.247		
	Union/Mgmt Support	0.388	0.082	4.715	➡0.000+
	Supervisors Correct	0.192	0.064	2.993	➡0.003
	Conditions Promote	0.200	0.071	2.792	➡0.006
	Physical Conditions	-0.212	0.077	-2.744	➡0.007
Mean = 2.58 S.D. = 1.06	r^2 = 0.240		N = 187		
Operation More Important	Constant	3.522	0.239		
	Supervisor's Rating	-0.258	0.076	-3.413	➡0.001
	Physical Conditions	-0.218	0.083	-2.635	➡0.009
Mean = 2.33 S.D. = 1.16	r^2 = 0.134		N = 192		

➡Significant at 0.05 level or less | ➡Significant at 0.01 level or less

FIGURE 11 - Pedestrian Attitude - Page 35

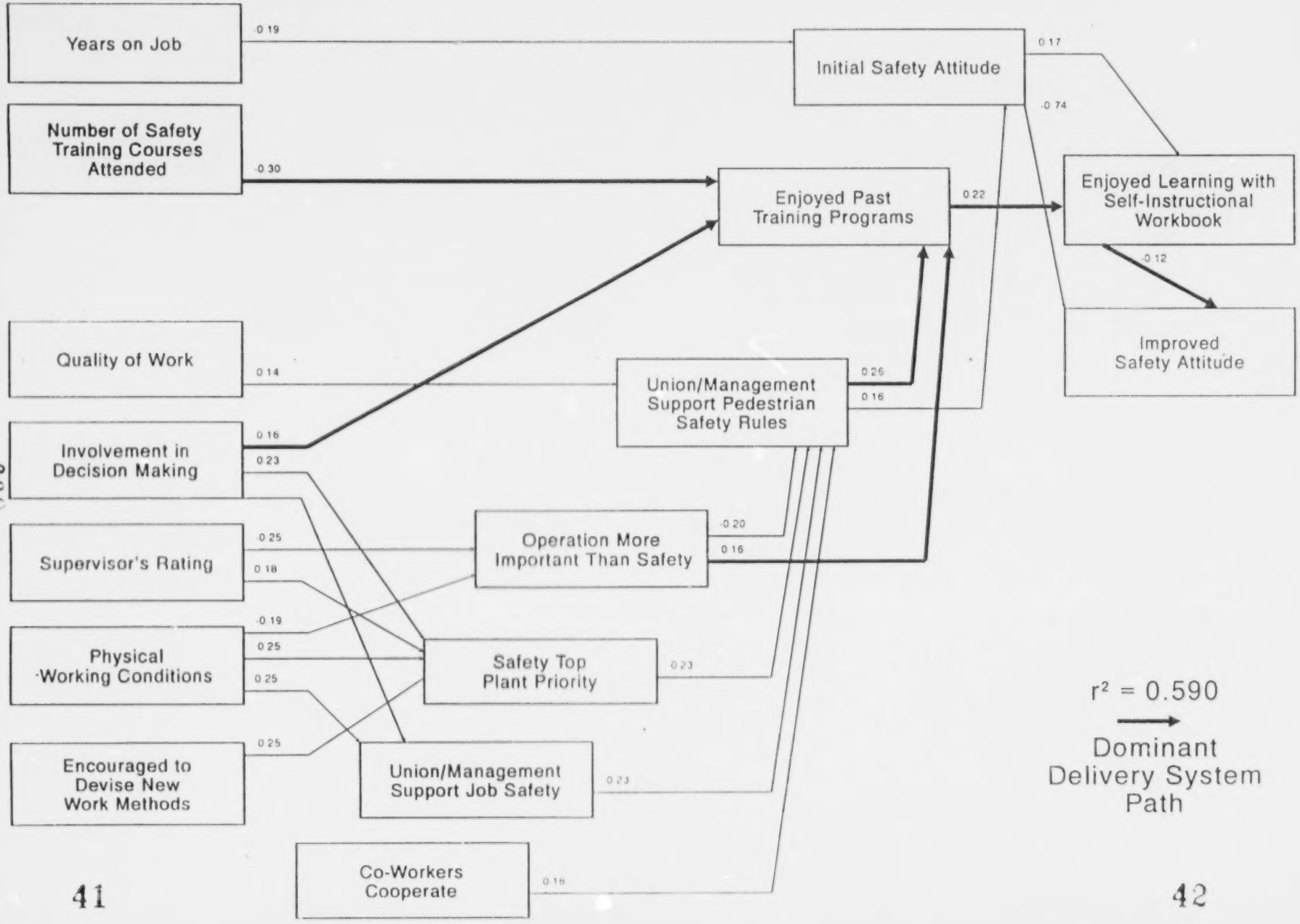

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TABLE 7
Hypothesized Effects of Delivery System Preferences on Attitude Changes After Training (PMHV Pedestrian Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Enjoyed Learning with Self-Inst Workbook	Constant	1.738	0.259		
	Enjoyed Past Training	0.296	0.110	2.701	➡0.008
	Initial Safety Attitude	0.146	0.070	2.080	➥0.039
Mean = 2.57	$r^2 = 0.078$		N = 145		
Enjoyed Past Training Programs	Constant	1.626	0.230		
	Number of Programs	-0.130	0.030	-4.340	➡0.000+
	Union/Mgmt Support	0.199	0.060	3.290	➡0.001
	Decision Involvement	0.101	0.045	2.239	➥0.026
	Operation Important	0.092	0.044	2.098	➥0.037
Mean = 2.12 S.D. = 0.693	$r^2 = 0.169$		N = 179		
Initial Safety Attitude	Constant	1.545	0.207		
	Years on Job	-0.124	0.045	-2.731	➡0.007
	Union/Mgmt Support	0.177	0.079	2.248	➥0.026
Mean = 1.67 S.D. = 0.98	$r^2 = 0.066$		N = 191		
Union/ Management Support Pedestrian Safety Rules	Constant	1.059	0.259		
	Safety Top Priority	0.160	0.048	3.355	➡0.001
	Union/Mgmt Support	0.192	0.056	3.418	➡0.000+
	Operation Important	-.0153	0.050	-3.053	➡0.003
	Co-workers Support	0.165	0.055	2.974	➡0.003
	Quality of Work	0.126	0.058	2.178	➥0.031
Mean = 2.12 S.D. = 0.87	$r^2 = 0.365$		N = 187		
Union/Mgmt Support Safety	Constant	0.867	0.210		
	Physical Conditions	0.261	0.074	3.514	➡0.000+
	Decision Involvement	0.239	0.070	3.433	➡0.000+
Mean = 2.14 S.D. = 1.03	$r^2 = 0.177$		N = 194		
Safety Top Plant Priority	Constant	0.591	0.247		
	Decision Involvement	0.272	0.089	3.041	➡0.003
	Encouraged to Devise	0.298	0.084	3.543	➡0.000+
	Supervisor's Rating	0.207	0.080	2.604	➡0.010
Mean = 2.50 S.D. = 1.16	$r^2 = 0.265$		N = 194		

➥Significant at 0.05 level or less ➡Significant at 0.01 level or less

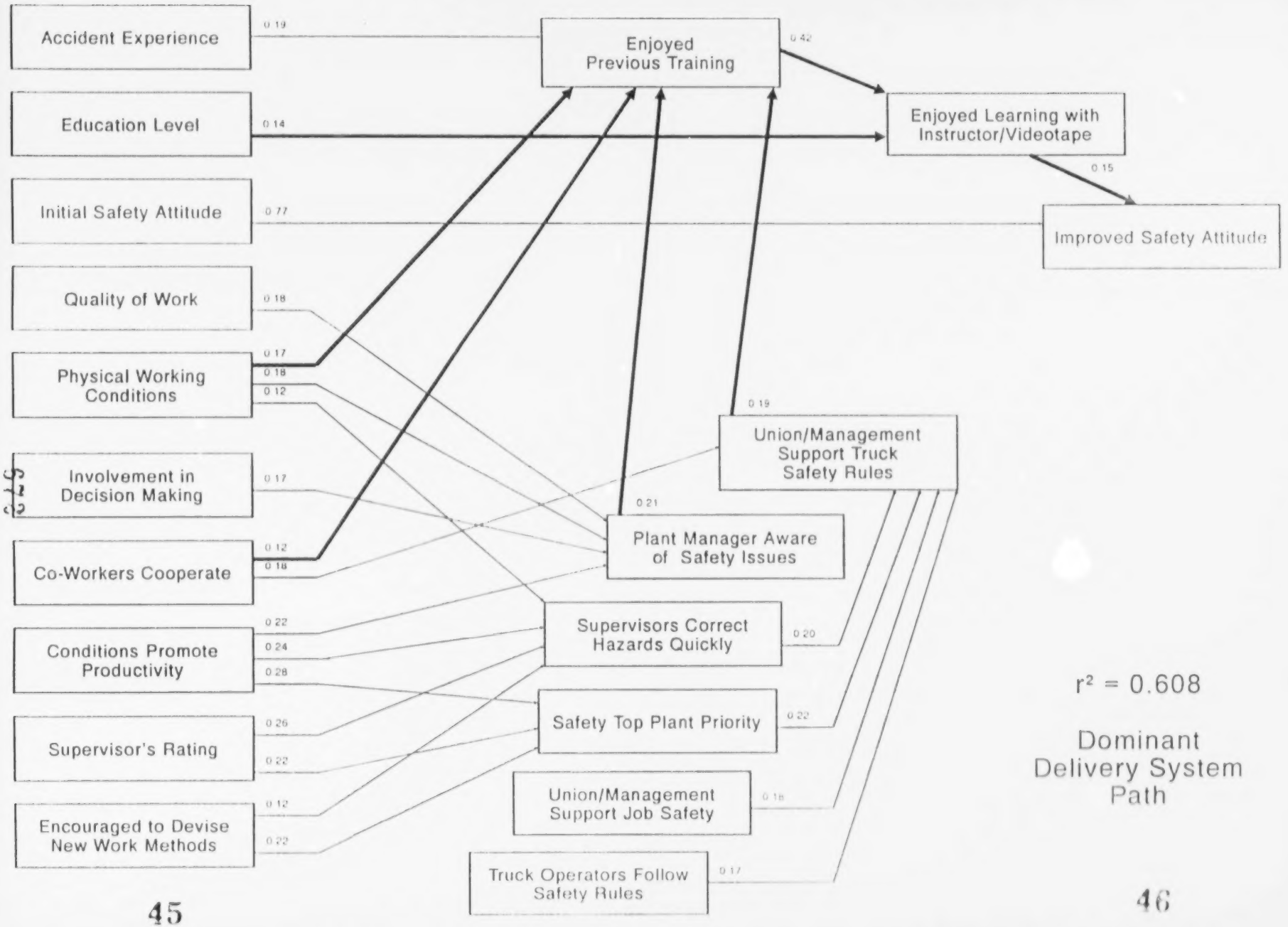
TABLE 7 (Continued)
Hypothesized Effects of Delivery System Preferences on Attitude Changes After Training (PMHV Pedestrian Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Operation More Important Than Safety	Constant	3.522	0.239		
	Supervisor's Rating	-0.258	0.076	-3.413	➡0.000+
	Physical Conditions	-0.218	0.083	-2.635	➡0.009
Mean = 2.33 *S.D. = 1.16*	$r^2 = 0.134$		N = 192		

Dependent Variable	Causal Variable	B	SE B	T	p
Gain in Safety Attitude	Constant	2.152	0.238		
	Initial Safety Attitude	-1.024	0.077	-13.260	
	Enjoy Self-Inst Wkbook	-0.165	0.080	-2.068	➡0.041
	$r^2 = 0.590$		N = 135		

➡Significant at 0.05 level or less ➡Significant at 0.01 level or less

FIGURE 12 - Operator Attitude - Page 38



$r^2 = 0.608$

Dominant Delivery System Path

TABLE 8
Hypothesized Effects of Delivery System Preferences on Attitude Changes After Training (PMHV Operator Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Enjoyed Learning with Inst/Videotape	Constant	0.667	0.201		
	Enjoyed Past Training	0.471	0.064	7.329	➡0.000+
	Educational Level	0.148	0.061	2.416	0.016
Mean = 1.76	r^2 = 0.194		N = 252		
Enjoyed Past Training Programs	Constant	1.250	0.141		
	Plant Manager Aware	0.132	0.040	3.296	➡0.001
	Union/Mgmt Support	0.161	0.049	3.266	➡0.001
	Accident Experience	-0.148	0.042	-3.529	➡0.000+
	Physical Conditions	0.120	0.043	2.761	➡0.006
	Co-workers Cooperate	0.093	0.045	2.052	➡0.041
Mean = 2.07 S.D. = 0.72	r^2 = 0.230		N = 281		
Union/ Management Support Truck Safety Rules	Constant	0.362	0.130		
	Supervisor Corrects	0.147	0.046	3.219	➡0.001
	Safety Top Priority	0.170	0.046	3.721	➡0.000+
	Union/Mgmt Support	0.159	0.051	3.112	➡0.002
	Operators Follow	0.131	0.041	3.164	➡0.002
	Co-workers Cooperate	0.096	0.043	2.204	➡0.028
Mean = 1.93 S.D. = 0.89	r^2 = 0.401		N = 296		
Safety Top Plant Priority	Constant	0.489	0.160		
	Conditions Promote	0.275	0.057	4.846	➡0.000+
	Supervisor's Rating	0.272	0.064	4.266	➡0.000+
	Encouraged to Devise	0.218	0.059	3.705	➡0.000+
Mean = 2.21 S.D. = 1.11	r^2 = 0.302		N = 307		
Supervisorss Correct Hazards Quickly	Constant	0.606	0.175		
	Conditions Promote	0.239	0.062	3.844	➡0.000+
	Supervisor's Rating	0.337	0.068	4.940	➡0.000+
	Physical Conditions	0.132	0.064	2.081	➡0.038
	Encouraged to Devise	0.124	0.061	2.030	➡0.043
Mean = 2.46 S.D. = 1.13	r^2 = 0.297		N = 306		

➡Significant at 0.05 level or less ➡Significant at 0.01 level or less

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TABLE 8 (Continued)
Hypothesized Effects of Delivery System Preferences on Attitude Changes After Training (PMHV Operator Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Plant Manager Aware of Safety Issues	Constant	0.488	0.178		
	Physical Conditions	0.201	0.067	3.015	➨0.003
	Conditions Promote	0.220	0.057	3.884	➨0.000+
	Quality of Work	0.236	0.072	3.280	➨0.001
	Decision Involvement	0.172	0.058	2.966	➨0.003
Mean = 2.38 *S.D. = 1.12*	r^2 = 0.300		N = 301		

Dependent Variable	Causal Variable	B	SE B	T	p
Gains in Safety Attitude	Constant	1.188	0.145		
	Initial Safety Attitude	-1.059	0.062	-17.216	➨0.000+
	Enjoy Inst/Videotape	0.180	0.054	3.353	➨0.001
	r^2 = 0.608		N = 199		

➨Significant at 0.05 level or less | ➨Significant at 0.01 level or less

FIGURE 13 - Pedestrian Behavior - Page 41

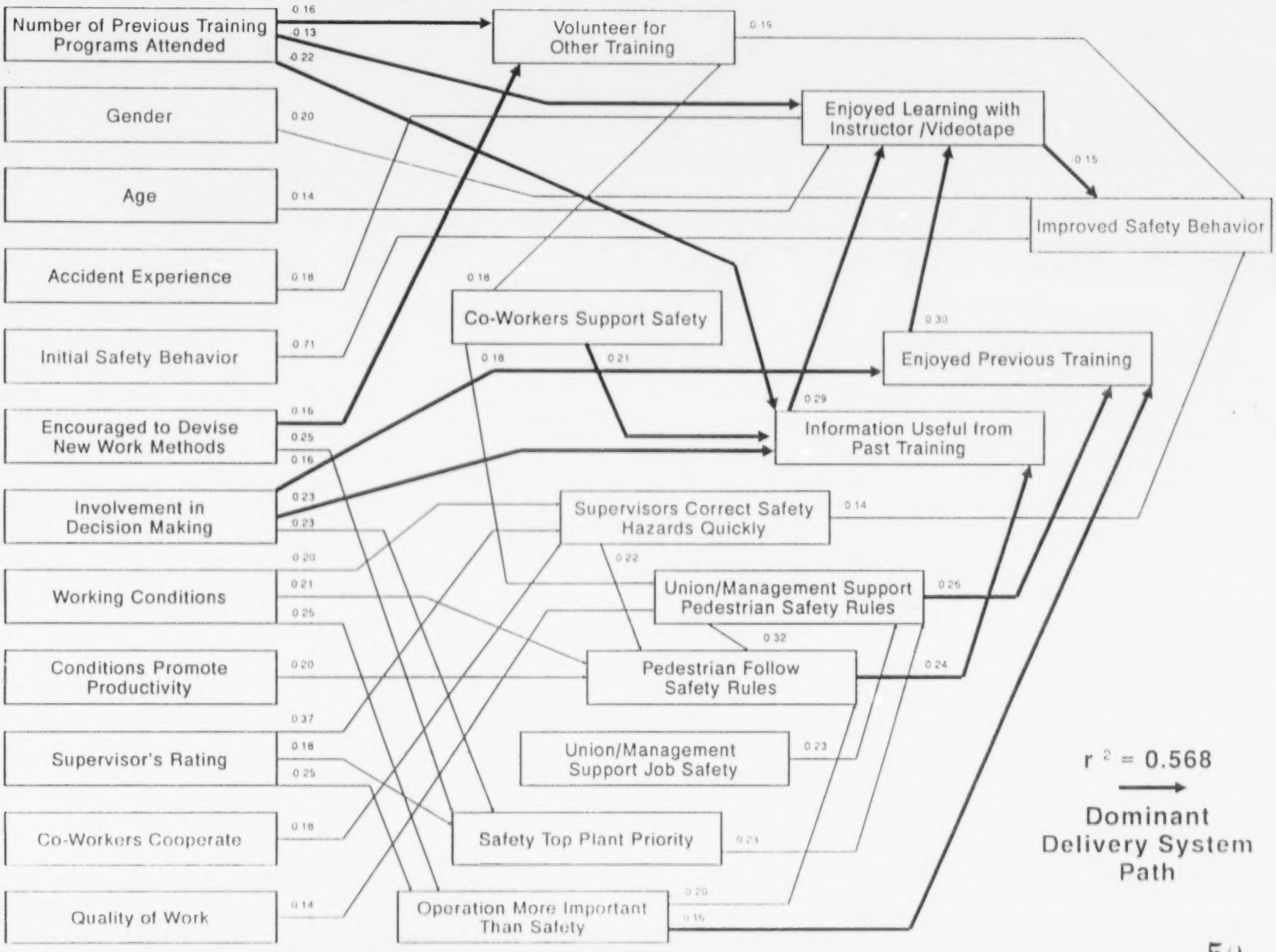

TABLE 9
Hypothesized Effects of Delivery System Preferences on General Behavior Changes After Training (PMHV Pedestrian Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Enjoyed Learning with Instructor/ Videotape	Constant	0.269	0.354		
	Past Tng Info Useful	0.352	0.107	3.297	➡0.001
	Enjoyed Past Training	0.366	0.108	3.401	➡0.001
	Accident Experience	0.150	0.060	2.509	➡0.013
	Gender	-0.130	0.065	-2.011	➡0.046
Mean = 2.06	r^2 = 0.369		N = 138		
Enjoyed Past Training Programs	Constant	1.626	0.230		
	Programs Attended	-0.130	0.030	-4.340	➡0.000+
	Union/Mgmt Support	0.199	0.060	3.290	➡0.001
	Decision Involvement	0.101	0.045	2.239	➡0.026
	Operation Important	0.092	0.044	2.098	➡0.037
Mean = 2.12 S.D. = 0.69	r^2 = 0.169		N = 179		
Past Training Information Useful	Constant	1.279	0.190		
	Decision Involvement	0.142	0.044	3.219	➡0.002
	Co-Workers Support	0.153	0.051	3.015	➡0.003
	Pedestrians Follow	0.145	0.044	3.298	➡0.001
	Number of Programs	-0.093	0.030	-3.120	➡0.002
Mean = 2.03 S.D. = 0.70	r^2 = 0.247		N = 164		
Volunteer for Other Training	Constant	1.882	0.238		
	Co-workers Support	0.166	0.067	2.475	➡0.014
	Number of Programs	-0.089	0.040	-2.207	➡0.029
	Encouraged to Devise	0.129	0.059	2.268	➡0.032
Mean = 2.22 S.D. = 0.89	r^2 = 0.089		N = 183		
Pedestrians Follow Safety Rules	Constant	1.293	0.247		
	Union/Mgmt Support	0.388	0.082	4.715	➡0.000+
	Supervisors Correct	0.192	0.064	2.993	➡0.003
	Conditions Promote	0.200	0.071	2.792	➡0.006
	Physical Conditions	-0.212	0.077	-2.744	➡0.007
Mean = 2.58 S.D. = 1.06	r^2 = 0.240		N = 187		

➡Significant at 0.05 level or less | ➡Significant at 0.01 level or less

TABLE 9 (Continued)
Hypothesized Effects of Delivery System Preferences on General Behavior Changes After Training (PMHV Pedestrian Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Union/Mgmt Support Pedestrian Safety Rules	Constant	1.059	0.259		
	Safety Top Plant Priority	0.160	0.048	3.355	➡0.001
	Union/Mgmt Support	0.192	0.056	3.418	➡0.000+
	Operation Important	-0.153	0.050	-3.053	➡0.003
	Co-workers Support	0.165	0.055	2.974	➡0.003
Mean = 2.12	Quality of Work	0.126	0.058	2.178	➡0.030
S.D. = 0.87					
	r^2 = 0.365		N = 187		
Operation More Important	Constant	3.522	0.239		
	Supervisor's Rating	-0.258	0.076	-3.413	➡0.001
	Physical Conditions	-0.218	0.083	-2.635	➡0.009
Mean = 2.33					
S.D. = 1.16	r^2 = 0.134		N = 192		
Safety Top Plant Priority	Constant	0.591	0.247		
	Decision Involvement	0.272	0.089	3.041	➡0.003
	Encouraged to Devise	0.298	0.084	3.543	➡0.001
	Supervisor's Rating	0.207	0.080	2.604	➡0.010
Mean = 2.50					
S.D. = 1.26	r^2 = 0.265		N = 194		
Supervisors Correct Hazards Quickly	Constant	0.616	0.247		
	Supervisor's Rating	0.406	0.071	5.761	➡0.000+
	Physical Conditions	0.249	0.080	3.126	➡0.002
	Co-workers Cooperate	0.223	0.076	2.927	➡0.004
Mean = 2.82					
S.D. = 1.21	r^2 = 0.324		N = 194		

Dependent Variable	Causal Variable	B	SE B	T	p
Gain in General Safety Behavior	Constant	1.430	0.362		
	Initial Safety Behavior	-0.963	0.079	-12.237	➡0.000+
	Volunteer for Programs	0.309	0.097	3.185	➡0.002
	Enjoy Inst/Videotape	-0.265	0.105	-2.515	➡0.013
	Supervisors Correct	0.164	0.068	2.405	➡0.018
	r^2 = 0.568		N = 134		

➡Significant at 0.05 level or less | ➡Significant at 0.01 level or less

FIGURE 14 - Operator Behavior - Page 44

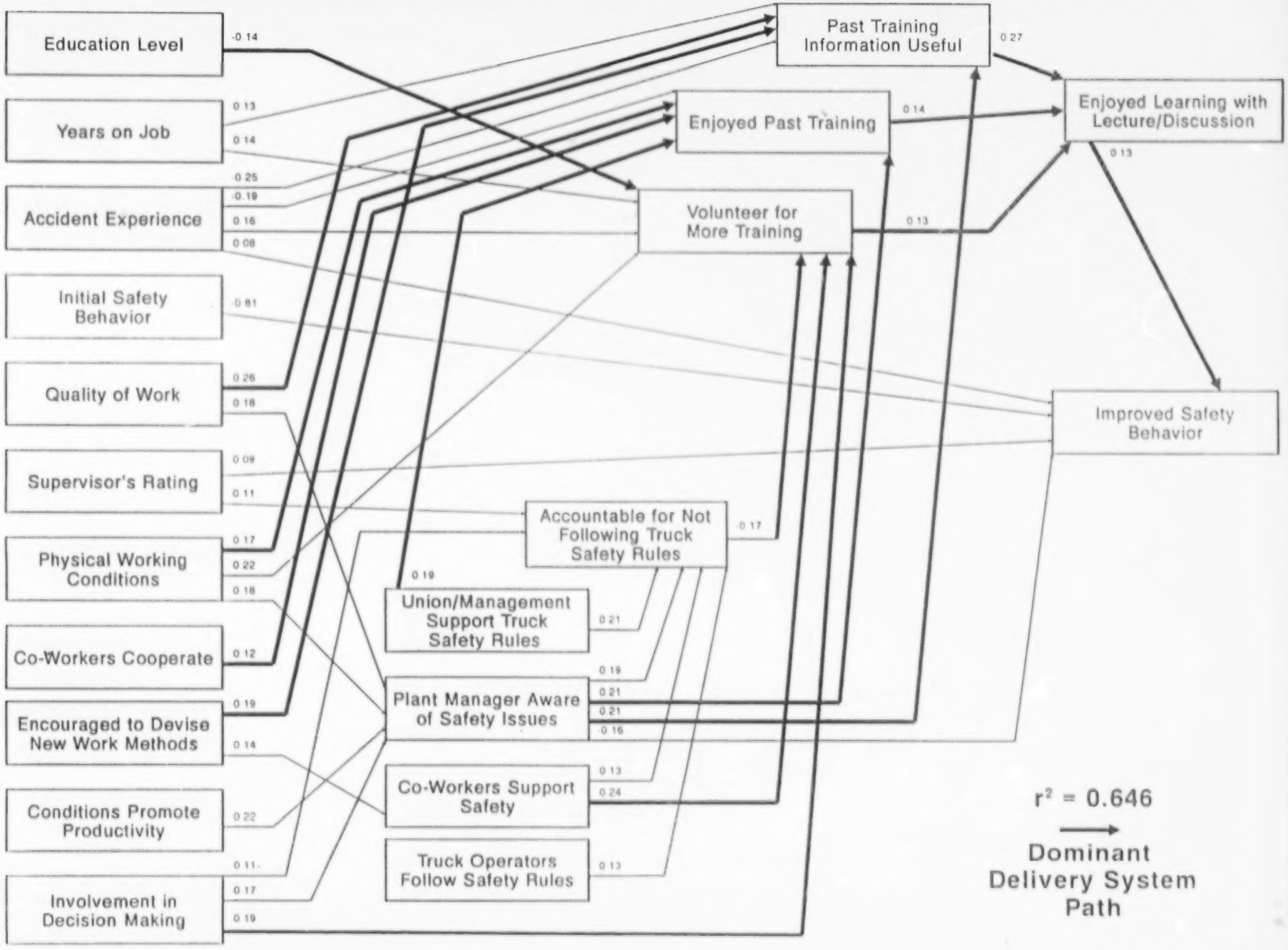

TABLE 10
Hypothesized Effects of Delivery System Preferences on General Behavior Changes After Training (PMHV Operator Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Enjoyed Learning with Lecture/ Discussion	Constant	0.845	0.141		
	Past Tng Info Useful	0.290	0.080	3.596	➡0.000+
	Volunteer for Training	0.102	0.052	1.960	0.051
	Enjoyed Past Training	0.140	0.076	1.846	0.066
Mean = 1.91	r^2 = 0.205		N = 255		
Volunteer for Other Training	Constant	1.582	0.270		
	Physical Conditions	0.203	0.064	3.189	➡0.002
	Co-workers Support	0.228	0.062	3.700	➡0.000+
	Educational Level	-0.173	0.078	-2.218	➡0.028
	Decision Involvement	0.164	0.058	2.802	➡0.006
	Accountable for Rules	-0.159	0.065	-2.461	➡0.015
	Accident Experience	-0.159	0.066	-2.388	➡0.018
	Years on Job	0.082	0.037	2.166	➡0.031
Mean = 2.09 S.D. = 0.93	r^2 = 0.199		N = 214		
Past Training Information Useful	Constant	1.217	0.162		
	Quality of Work	0.217	0.054	4.028	➡0.000+
	Plant Manager Aware	0.132	0.042	3.123	➡0.002
	Accident Experience	-0.202	0.049	-4.089	➡0.000+
	Encouraged to Devise	0.124	0.042	2.946	➡0.004
	Years on Job	0.059	0.028	2.121	➡0.035
Mean = 2.04 S.D. = 0.71	r^2 = 0.260		N = 212		
Enjoyed Past Training Programs	Constant	1.250	0.141		
	Plant Manager Aware	0.132	0.040	3.296	➡0.001
	Union/Mgmt Support	0.161	0.049	3.266	➡0.001
	Accident Experience	-0.148	0.042	-3.529	➡0.000+
	Physical Conditions	0.120	0.043	2.761	➡0.006
	Co-workers Cooperate	0.093	0.045	2.052	➡0.041
Mean = 2.07 S.D. = 0.72	r^2 = 0.230		N = 281		
Co-workers Support Safety	Constant	0.544	0.129		
	Encouraged to Devise	0.132	0.053	2.507	➡0.013
Mean = 1.83 S.D. = 1.00	r^2 = 0.020		N = 305		

➡Significant at 0.05 level or less | ➡Significant at 0.01 level or less

TABLE 10 (Continued)
Hypothesized Effects of Delivery System Preferences on General Behavior Changes After Training (PMHV Operator Safety Training)

Endogenous Variable	Causal Variable	B	SE B	T	p
Accountable For Not Following Truck Safety Rules	Constant	0.148	0.171		
	Union/Mgmt Support	0.239	0.065	3.658	➡0.000+
	Plant Manager Aware	0.164	0.052	3.168	➡0.002
	Supervisor's Rating	0.115	0.059	1.953	0.052
	Co-workers Support	0.121	0.048	2.496	➡0.013
	Operators Follow Rules	0.110	0.051	2.159	➡0.031
	Decision Involvement	0.010	0.048	2.082	➡0.038
Mean = 1.95 S.D. = 0.954	r^2 = 0.321		N = 291		
Union/ Management Support Truck Safety Rules	Constant	0.362	0.130		
	Supervisor Corrects	0.147	0.046	3.219	➡0.001
	Safety Top Priority	0.170	0.046	3.721	➡0.000+
	Union/Mgmt Support	0.159	0.051	3.112	➡0.002
	Operators Follow	0.131	0.041	3.164	➡0.002
	Co-workers Cooperate	0.096	0.043	2.204	➡0.028
Mean = 1.93 S.D. = 0.89	r^2 = 0.401		N = 296		
Plant Manager Aware of Safety Issues	Constant	0.488	0.178		
	Physical Conditions	0.201	0.067	3.015	➡0.003
	Conditions Promote	0.220	0.057	3.884	➡0.000+
	Quality of Work	0.236	0.072	3.280	➡0.001
	Decision Involvement	0.172	0.058	2.966	➡0.003
Mean = 2.38 S.D. = 1.12	r^2 = 0.300		N = 301		

Dependent Variable	Causal Variable	B	SE B	T	p
Gain in General Safety Behavior	Constant	1.324	0.175		
	Initial Safety Behavior	-1.017	0.064	-15.955	➡0.000+
	Enjoy Lecture/Discussion	0.166	0.058	2.841	➡0.005
	Plant Manager Aware	-0.132	0.041	-3.250	➡0.001
	Accident Experience	0.083	0.047	1.759	0.080
	Supervisor's Rating	0.097	0.055	1.776	0.078
	r^2 = 0.646		N = 184		

Significant at 0.05 level or less | Significant at 0.01 level or less